THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. BERLY'S)

1909 EDITION

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ELECTRICAL EXPORTING.

ON many occasions during the last few years we have urged British electrical firms to devote their attention more zealously to certain foreign markets. This was not because we took a particular pleasure in reproaching our manufacturers for their lack of enterprise, but rather because we thought that in some cases they had not had put before them as plainly as we had, the greatness of the opportunities that awaited those who were willing to make the sacrifice necessary in order to grasp them. We sometimes feel that electrical and engineering firms do not avail themselves as completely as they might and should, of the material that is put before them in the trade and technical Press—material which is sought out or gathered and published with the sole object of enabling them to extend their business operations. In the course of our own experience again and again has it happened that questions have been put to us regarding matters of importance by men who regularly took the ELECTRICAL REVIEW, and when we have pointed out chapter and verse in our own pages, where we had already made available for them things which it was in their interest to know weeks before, the answer has been, "Oh! then that must have been a week when I was away, or when I was too busy to look at my REVIEW carefully; I've got my copy. Thanks very much, I'll look it up." We can hardly conceive of there being many manufacturers who neglect the available information regarding contracts open—doubtless there are few indeed, if any, who are not on the alert for that, though it is a matter left more to the purview of a special staff or department. But what of all the other material that we obtain which is intended to aid business-getting operations? Our own part as editors is fulfilled when we have secured and published, and we always reckon that in whatever type or on whatever page articles or notes appear, they are of special value to a portion of our readers. The manufacturer or trader ought to see for himself that among his principals or his staff there is somebody of competence and responsibility who will see that whatever hint or article published in our pages bears upon his business shall be taken advantage of to the full. It ought to be impossible for any single page, let alone a complete issue, to be passed over. We are occasionally told that we publish too much—far more than a man can read and digest between whiles in the course of a week. We offer no objection to the criticism, for it is, to our way of thinking, a very good fault—it tells us that the very object at which we aim we are achieving. We, however, must leave it to every man to sort out from the variety that we give, that which is of most interest to his own department of electrical engineering or industry. Men who are in the business to make money cannot afford to peruse their trade journals "between whiles." They should make it a definite part of their week's work.

The foregoing thoughts occur to us as we ponder over the attempts that we have constantly been making to use our organisation, including contributors in all parts of the world, for enlightening those who have electrical manufactures to sell, concerning markets where they will find it well worth while to try their luck. Our advice generally has a solid foundation for its basis; either a special contributor writes from the heart of the promising centre, or a Consular report appears which is of more than average importance (how many firms obtain these documents for themselves?), or a visitor has given us a call shortly after reaching these shores, imparting to us reproofs, advices or encouragements, as the case may be, for us to pass on through our columns to the traders of the United Kingdom.

Our consistency in pursuing the above course has aroused the jealousy of some scribes who have tried to do the same thing and failed, and they with that cheap Charivari tendency which some seem to think there is a need for in modern technical journalism, credit us with having only one word of hope for the electrical industry, and that is to "go to the Antipodes." But if we make a study of the electrical exports from this country—we gave some interesting figures in reply to a correspondent last week—we are led to the conclusion that going to the outer parts of the world has been a far more satisfactory experience than sitting round a board table at home could have been, and, we trow, much more profitable in orders than waiting round the doors of that building which shelters more electrical companies than any other in the United Kingdom.

Coming now from the general to the particular, we have two points that we desire to bring into present prominence—one is a report on increased trade between this country and New Zealand; the other is the necessity for putting forth a renewed and greater effort to meet the electrical needs of Canada. Both of these are largely the lands of our own relations, and both give a preferential treatment to the manufactures of the Home Country, so the markets are, at any rate, more favourable than some to spend our strength upon.

What about New Zealand? Blue-Book Cd. 3,867 is a report on the prospects of British trade with this Colony, and the conclusions drawn therefrom are these:—The market is small in comparison with Canada, yet it is considerable, and is steadily expanding, and "presents great possibilities for the future." The British exporters have by far the greatest share, and that share declined gradually until 1902, but in that year the downward movement was checked. Then note this: "This improvement is undoubtedly due in part to the greater energy displayed by British manufacturers and traders who have succeeded in some instances in recovering ground which they had lost." To some extent, also, the improvement is the effect of the 1903 preferential arrangements. Later we observe the competition of the U.S., Germany, France and Belgium, which is a very active one, but we read on:—"There are a few classes of goods which the United Kingdom might supply in which the trade is held almost entirely by foreign countries, but . . . . the goods obtained from foreign countries are, in the main . . . . cheap lines with which British manufacturers—rightly or wrongly—have not cared to trouble themselves." Now for the grand finale:—"It appears then, that with the exercise of reasonable vigilance and attention to the desires and, perhaps, the prejudices of the consumers, there is no reason why British traders should not maintain and even improve their position in the New Zealand market."

So then here, in spite of aforesaid contemporary criticism, we have both a Blue-Book and our own blue selves singing in canon form "Go to the Antipodes," instead of softly humming "Home, Sweet Home." We hope that British manufacturers will dwell upon the recommendations of this Blue-Book, and will not only try more energetically to sell in New Zealand what they already make, but will make to sell there something which Continental and American rivals have had sufficient foresight and enterprise to produce as specially suitable for the local requirements.

From New Zealand to Canada is a far cry, but the teaching is much the same from both places. We have no Blue-Book from Canada just now it is true, but we have the personal testimony of a Canadian electrical engineer who is on a visit to these shores, and that is, perhaps, in one respect of greater interest, because you can question and cross-question your visitor, while your Blue-Book, when once you have read it, has only the eloquence of silence. We learn from him, as we have learned from others whose views we have published, that there is far more to be done in Canada by the British electrical manufacturer if he will only take the necessary trouble; that our comparative littleness in the electrical markets there is due to our missing opportunities several years ago; that America has been allowed practically unhindered to become entrenched there, spreading American electrical material with a foresight and an insight at the psychological moment, so that the Canadian has been got into the way of wanting the American article; that the Canadian has got into the way of thinking that we in the Old Home were so happy and contented, doing business, electrically, between ourselves, that we did not need to cross the seas and seek their favours; that we were further disinclined to take the trouble to cater for their requirements, notwithstanding the preferential treatment accorded to us; that in the matter of price we could, for various reasons, compete successfully with the American maker who has specially erected works in Canada; and that even Sweden, with less favourable treatment than ourselves, finds a market for electrical manufactures.

And above and beyond all these points there lies the grand dream of development of the Dominion, requiring thousands of public and other electric light and power plants in the course of years as township after township spreads its borders, of thousands of miles of electric tramway and railway that we in our later years, or our children in their manhood, ought to have the opportunity of installing and equipping, if only we are there in time. But it is not our customary practice to indulge in imaginative flights as to the future, save in so far as they ought to guide us as to the best policy to adopt at the moment. We are too busy trying to live to-day to think of the years that are to be. "We cannot afford to go abroad," say some. There is a thought somewhere about taking our ease, eating, drinking, and being merry, for to-morrow we die. We will take our fees, and, if any, our dividends to-day and to-morrow, and on the third day we will liquidate. Better were it to conserve our capital by putting our fees or dividends out in new efforts for a while. Better to pay a man £1,000 to open new ground than £500 to carry on the undercutting war at home. The latter weakens for to-day and to-morrow too, the former may be a profitable investment for this year and five others yet to come.

We profoundly hope that the electrical manufacturers of the United Kingdom will not longer fling away their chances of doing business in Canada. It is passing strange that a thirsty soul should stand sipping scantily when an overflowing bowl invites the first comer to drink deeply. Earl Grey, the Governor-General of Canada, made it one of his first duties when landing in this country this week for a short stay, to write to the Press drawing attention to the desirability of British manufacturers taking advantage of an opportunity that is being made for them to get into closer touch with the Canadian consumer. It is pointed out that the Canadian National Exhibition at Toronto is annually assuming a more important position in the commercial and industrial life of Canada. At that exhibition which opens at the end of August—which date renders immediate attention to the matter imperative—space is available free of charge to Boards of Trade or Chambers of Commerce in Britain which are willing to make a collection of exhibits. Can the National Electrical Manufacturers' Association avail itself of the offer in some way?

The smallness of the Canadian electrical imports from this country may be due to several things, but from reports that reach us from time to time it carries with it a reproach to the British manufacturer. We have written on this subject before, and in recent years have noted in the Canadian journals that more of our firms are advertising their manufactures there, though chiefly through agents, than were doing so when we made an investigation of the position several years ago. But the conversation that we have just had with our Canadian friend fixes painfully upon our mind

the poor impression that our cousins across the sea have obtained regarding our independence of them electrically. We believe that we are wanted there; that if we go about the business with befitting zeal and enterprise and a desire to meet their requirements, we shall be welcomed.

Once again we have delivered our message on this overwhelmingly important matter. We leave it, together with its attendant responsibility, with the members of the trade themselves, for with them must it lie to go forward to success, making the electrical exports to New Zealand and Canada increase at a far greater rate during the next five years than during the past five.

A POSSIBLE COAL STRIKE AND ELECTRICITY SUPPLY.

From what we can gather, the present situation with regard to the supply of industrial coal in Great Britain is one requiring consideration. What the ultimate result will be no one can say, but the electricity supply industry might be placed in a serious position should such a calamity as a strike occur.

It will perhaps be profitable briefly to review the position. In every county in which collieries exist to any extent the miners have a Union, which is an association created for the purpose of protecting and promoting the interests of the workers within their respective areas. These Unions are united together into a National Federation for the purpose of concerted action on questions of general importance, such, for instance, as the present Eight Hours Act. The masters in the various counties have also their organisations, and these two forces are at present in opposition. In each county there is established a Conciliation Board composed of representatives of the masters and the men, to which local and county disputes, including those concerning wages, are referred, and in the absence of a settlement they are sent to arbitration.

The operation of the Eight Hours Act for miners is expected to introduce difficulties in working, which it is claimed by the masters will lead to a serious diminution of profits; but, of course, the workers hold a contrary opinion. As the miners' wages are fixed from time to time by a sliding scale dependent on the selling price of the coal, the employers are asking for a reduction of prices paid to the workmen in consequence of the altered conditions involving increased cost. It is contended by some of the masters that the Conciliation Board cannot deal with this question adequately, as while the effect of the Act may be to reduce profits almost to the vanishing point, it may not perceptibly affect the selling price of the coal. The Scottish miners, on the other hand, object to the matter going to the Conciliation Boards on the grounds that any reduction might reduce the wages below the minimum wage agreed on between the Scottish masters and the miners, from which it will be seen that there appears to be a general deadlock that may develop into a strike, which would be on a scale never before achieved, as it would extend over the whole country.

An important ray of hope is to be found in the fact that in Northumberland the miners have appointed a committee with the view of finding a peaceful solution of the difficulty. In Durham, so far, no move has been made by either masters or men. It may be noted in passing, that while both Northumberland and Durham are now in the Federation, they for a long time refused to join it, as they were opposed to a compulsory eight-hours' day, and in this respect differed from the policy of the Federation. In anticipation of a strike the Scottish miners have sent a deputation across to the Continent in order to place the position before the German, French and Belgian miners, possibly with a view to securing Continental support in the event of a strike.

It would appear as though in the North of England the operative colliery engineers and boiler men are thinking seriously on the matter, and are not inclined to repeat their mistake of 1892 when they came out in Durham with the miners, with the result that many of the pits were flooded to such an extent that some of them could not be pumped dry for months after the strike ended, thus putting masters and men alike to great loss. At a recent meeting of the local Union of the men referred to, the chairman spoke strongly on the lines indicated. There was to be a meeting of the Miners' Federation in London yesterday, the 17th inst., to consider what united action should be taken, and the decision arrived at may be of far-reaching national importance. It is, perhaps, premature to consider what the effects of a general strike would be upon the various electric supply undertakers. A universal strike is unthinkable, and it would seriously affect every department of industry and every walk in life, so it is perhaps a detail of limited interest at the moment as to where a supply authority would stand in regard to its relationship with its consumers. It savours almost of the ridiculous in these days to suggest a possibility of hundreds of electricity supply authorities being unable to give a continuous supply.

In most agreements relating to bulk supply to large manufacturers a clause is inserted which protects the undertakers from any claims upon them should the interruption of the supply be due to a strike, but a far larger class of consumers are those who do not get their energy from a power supply company, but from undertakers supplying under provisional orders, which incorporate the sections of the Electric Lighting Acts placing upon the undertaker the obligation (under penalty) to give a continuous supply, and under the stringent clause referred to the undertakers are liable to a penalty, in every case of failure except in the case of inevitable accident, or by *force majeure*. A universal strike rendering supplies of coal unobtainable would, it seems to us, be regarded by the Courts as a matter quite beyond the control of the electricity suppliers, and a contingency not thought of when the penalty of 40s. per day for failure to supply was provided for in the Acts. Imagine the impossible state of things that would be produced. Every man's hand would be raised against his neighbour in the Courts, claiming the imposition of penalties or the payment of damages consequent upon the interference with industry following a temporary scarcity of coal. Before the Courts would put penalties upon electricity suppliers, it would have to be proved that the latter had in some way or other failed in the reasonable fulfilment of their duty.

We are informed that some of the railway companies have already stored considerable quantities of coal in anticipation of a possible strike. Our informant goes so far as to suggest that electricity supply authorities would be well advised to make the most of the time available to store up a reserve stock of coal.

Accidents to Workmen.

Some interesting matter bearing on the question alluded to in our leaderette on "A Cause of Unemployment" in our last issue, appeared a week or two ago in the *American Machinist*, which states that in Allegheny County alone in one year there were 526 workmen killed by accidents, and over 2,000 men injured more or less severely. Over 42 per cent. of the men killed were native-born Americans, thus disposing of the quasi-comfortable idea that the killed were only common foreign labourers. Moreover, and this is the point we wish to emphasise, over 84 per cent. of the deaths were of men not over 40 years of age. This, so far as it goes, is a strong argument against the idea that men over 40 are more liable to accident. The idea, false as it is, is at the bottom of the modern refusal to employ elderly men. Men over 40 have learned to be careful, and can turn out as

much, and better work, than most of the half-trained younger men.

The older man is really the safer man to employ. He is less apt to thrust a hand or a finger into danger than is a younger man, and, even if his movements are not so rapid in all circumstances, he is likely to keep more steadily at work, and to do his work with less error than a less experienced man. Until actual feebleness overtakes a workman, it is questionable whether his efficiency falls off at all.

These American statistics should certainly command the careful attention of the insurance companies, to whose action, we believe, much of the unemployment of the older men is due, owing to the mistaken idea that they are more prone to accident.

Our Annual Tables.

We issue to-day the first of our annual statistical tables for this year—namely, that relating to the electrical tramways, railways and power companies of the United Kingdom—and trust it will be found useful for reference by our readers. The number of tramway undertakings at work has hardly changed, and there are few important extensions of existing tramways to record; in fact, with the exception of certain large undertakings—such as those of the L.C.C. and other important local authorities—tramway construction in this country seems to have fallen into complete stagnation.

Reductions in the number of passengers carried during the year are reported from numerous quarters, and in many cases the car-mileage has been correspondingly reduced, owing to the depression of trade. No change has taken place in the number of electric railways in operation; one of those in the list—that of the L.B. & S.C. Railway Co.—has, indeed, not yet commenced public service, though experimental running has been carried on for some time past. Much depends upon the successful working of this line—the first instance in this country of a suburban service on the single-phase system, though not the first A.C. system, priority in this respect having been secured by the Midland Railway. The directors of other railways are waiting ostensibly to see how the Brighton scheme works out, before they take any further steps towards the modernising of their own lines; but seeing that plenty of examples of successful single-phase working are extant, there are presumably other and perhaps more potent reasons at the root of their hesitation.

As for the power companies, those that are working are not too prosperous, while those that have not yet succeeded in making a start seem no nearer doing so. That trade depression is an important factor in all these departments of industry is undoubted, and as it cannot last for ever, we may confidently hope that before very long we shall have a very different report to make.

In conclusion, we wish to repeat our hearty thanks to the engineers, managers and secretaries of all these undertakings, whose courteous assistance alone enables us to produce our annual tables.

The Activity of the I.E.E.

Mr. Mordey's speech at the dinner of the Electrical Contractors' Association, which was couched in the optimistic vein which the President has so consistently maintained throughout his period of office, contained several items of more than ordinary importance.

Whether it is altogether desirable that the Institution should confine its attention wholly to the scientific and professional side of electrical engineering may be open to argument; indeed, it is questionable whether the claim that it does so is quite accurate—is it, indeed, *possible* so to differentiate between two phases of a subject so closely bound together? But that the Institution should take energetic steps towards the suppression of abuses, both trading and professional, is undoubtedly a praiseworthy and highly salutary proceeding. We understand that the Council is meditating the issue of recommendations regarding this matter early in the new session, and this will harmonise admirably with the house-warming of the new I.E.E. headquarters on the Embankment, which came into the possession of the Institution at the beginning of this month; the offices will be transferred in a few months, but owing to the alterations required, the ordinary meetings will not be held there until early next year.

The suggestion that, when next the Articles of Association are modified, adequate powers will be taken to deal effectively with members whose conduct is not in accordance with the standard set up, is also one that we welcome, tending as it does in the direction of the reform that we have advocated—namely, the institution of an authoritative General Engineering Council, empowered by Act of Parliament to impose and enforce a code of professional etiquette, and thus enabled to secure for qualified engineers a professional standing equal to that of the older, but not more honourable or more worthy professions.

Another point to which attention should be drawn is the forthcoming modification of the Wiring Rules of the Institution in the direction of admitting less expensive—cheap, but *not* nasty—systems of wiring houses for electric lighting, such as have been in use abroad for many years without detrimental results. This question requires very careful consideration: while reducing the cost of wiring to the utmost, the rules must effectually bar the use of unsafe systems of wiring, and the problem to be solved is one of very great difficulty. It seems incredible, however, that electricity, which in other cases is unequalled for the simplicity and flexibility of its applications, should be found wanting in the case of the small houses, of which such enormous numbers are at present lighted with gas, and which would prove so fruitful a field for cultivation by electricity supply undertakers and contractors.

Insurance against Unemployment.

Scarcely a day goes by upon which one does not witness the promulgation of some new scheme for the betterment of the working classes. The present Government are determined in their efforts to either help the working man, or to make him help himself. Time alone will show how far these efforts are to be successful. The latest proposal is to introduce a scheme of insurance against unemployment, towards the support of which the State and the workman will have to contribute. Mr. Churchill's idea, as outlined in a recent speech, is to take some of the greatest trades in the country in which unemployment is most serious, and the fluctuations most severe, and introduce a system of compulsory contributory insurance, with a large subvention from the State. The State assistance in unemployment insurance would not be limited to those trades in which it was compulsory, but they would offer facilities for a voluntary system of insurance in connection with trade societies or societies managed by groups of workmen. An actuary who has made calculations, said that the rates of invalidity insurance to cover a man till he was 70, were in many cases scarcely half what they would be if they had to cover him till death. What we regard as the most satisfactory feature of Mr. Churchill's scheme is his evident intention to *compel* the working man to contribute towards insurance. "I should work for such a policy," he says, "and try to carry it through, even if it were a little unpopular at first, and I should be willing to pay the forfeit of an exclusion from power in order to carry it through, because I know there is no other way within reach of the present generation by which the stream of preventable misery can be cut off." If only a tithe of what the working man now spends on drink were devoted to the purposes suggested by Mr. Churchill, the evils of unemployment would be greatly reduced. We see in these proposals something more than a temporary palliative for the seasonal changes in trade. In providing more relief work for the unemployed, the Government looks only to methods of feeding starving men for the few immediate months before them, and makes no attempt to prevent the recurrence of the depression.

THE ENGINEERING INDUSTRY AND THE "DAILY EXPRESS."

Having by its unique methods of calculation satisfied itself that a 10 per cent. tariff on electrical goods would result in the employment of 74,000 extra men, and increase the wages bill by £6,219,000 per annum (over three times the total value of the imports), the *Express* now turns its search-light on to the engineering industry generally, and by the adoption of similar methods arrives at somewhat similar results.

"Out of a total of 536 replies received," says the *Express*, "only 144 have stated that their business would not be increased by imposition of a 10 per cent. tariff." What a characteristic prevarication. Only 144 state that their business "will not be increased." What are the facts? Among this 144 are some of the most important firms in the whole world in their particular branch of the industry—such, for instance, as Harland & Wolff, Swan, Hunter & Wigham Richardson, Mather & Platt—and all these and other important firms go very considerably farther than the *Express* would imply by the expression quoted. Thus Messrs. Harland & Wolff say that "a duty would be disastrous to shipbuilding and engineering and other trades"; Messrs. Mather & Platt say "a duty such as suggested would seriously injure our export business"; whilst Mr. G. B. Hunter, chairman of the great Tyneside shipbuilding and engineering company, says that, although not opposed to tariff reform, "it is clear that the imposition of protective duties would not prevent unemployment, and would be 'dangerous to the prosperity of the United Kingdom.' Some of our industries would benefit, but shipbuilding, shipping, railway and some other industries, would suffer." Another reply, expressive of the personal views of the senior managing director of a large North of England shipbuilding and engineering firm, is to the effect that "their trade would be considerably reduced, owing to lack of foreign orders," and adds, "our hands would be reduced, possibly as much as even 50 per cent., and the wages bill would be reduced correspondingly."

A firm or textile machinery makers declare that "if a duty is put on raw material, we should very soon employ 500 men in place of 1,100, as at present." These, then, are the people who, as the *Express* puts it, "have stated that their business *would not be increased*" by the imposition of a duty. (The italics are ours.) Why not be honest about it and say straight out that the most important firms who replied declared that a tariff meant not only a reduction in the number of hands, but that the adverse effect on British trade would be disastrous. One finds it hard to believe that readers of the *Express*, accustomed as they must be to its reckless methods, will not feel that their intelligence is insulted when they are asked to accept the opinions of a small firm of tug-boat makers in South Shields and reject those of such shipbuilding and engineering firms as Harland & Wolff, upon whose prosperity the existence of Belfast largely depends, and of Swan, Hunter & Wigham Richardson, one of the largest and most important firms on Tyneside.

In view of the importation of American printing machinery, it would not be surprising if some British firms favoured an import duty; but we find that such a representative firm of printing machine makers as Messrs. W. Dawson and Sons, of Otley, reply to the *Express* that a duty would not benefit them *one iota*. They add "is it likely that we are going to take out the foundation stone of the bridge which has brought us success up to the present, as the year ending December 31st, 1908, has been one of our best years?"

The opinions of all the firms quoted are ignored by the *Express*; they are lumped together in the "only 144 firms who have stated that *their business would not be increased* by the imposition of a 10 per cent. *ad valorem* duty." Instead of attaching due weight to the views of engineering firms of national importance, we are asked to accept that of an unnamed Leicester firm who write, "Any person outside a lunatic asylum is bound to answer 'Yes' to the question whether a 10 per cent. duty will increase trade." It is a good thing for this country that the directors of Harland and Wolff, Mather & Platt, and the other firms named above are yet outside the walls of a lunatic asylum.

As we have pointed out in our previous articles on the *Express* methods of conducting an inquiry, we are not concerned so much with the respective merits of Free Trade and Protection as with the wilfully misleading methods of putting the case for the latter policy. Whilst we are sorely tempted to print the opinions of representative firms as given before the Tariff Commission against the views advanced by unnamed firms quoted in the *Express*, we must confine ourselves to pointing out the worthlessness of the figures and conclusions arrived at by the *Express*, and the unscrupulous methods by which the figures are computed. Let us again quote the sentence which is intended to accurately summarise the result of their so-called inquiry. "Out of 536 replies received there are only 144 who have stated that their business would not be increased by the imposition of a 10 per cent. *ad valorem* duty." We have already shown how far short of the truth this sentence falls, in so far as it deals with the views of the 144. If we re-write the sentence in such a way as to express the naked truth of the matter, it will read: "Out of a total of 536 replies received, there are *only 244* who state that their business *would be* increased by the imposition of a 10 per cent. *ad valorem* duty, and *only 113 give estimates* of the extra number of hands *they think* they could employ." This puts a very different complexion on the matter. Less than half the replies (45 per cent. approximately) are favourable, and only one-fifth give definite figures. According to the *Express*, there are over 4,000 engineering firms, so the 113 who give figures form about 3 per cent. of the total number. Three per cent. is not a large proportion at best, and when we consider that most of the firms included in this small minority are unnamed, whilst many who are named are not those one would place in the front rank of engineering firms, it is nothing short of an insult to the engineering trades to put forward their opinions as representative of the great engineering industries.

But this unknown 3 per cent. is quite enough for the *Express* expert, who can make a few figures go a long way. What does he make of this insignificant 3 per cent.? This is how he deals with it:—"The 113 firms giving definite estimates of extra employment and wages are 21 per cent. of the total number who replied. Assuming that there are only 4,000 engineering firms, and that 21 per cent. could give increased employment and wages in the same proportion as those who gave estimates, the totals would be as follows:—

Estimated for the whole trade:—Extra hands 69,720, extra weekly wages £110,040.

Thus, it will be seen that, according to the *Express*, a 10 per cent. import duty on imported manufactured goods would result, according to the views of 3 per cent. of the trade, in an increase of wages amounting to nearly £6,000,000 per annum, a sum which exceeds the total value of engineering imports. No allowance whatever is made for the number of men who would lose their employment as a result of the tariff, although some of the most important employers of labour in the kingdom say that it would be disastrous to shipbuilding, shipping, railways and engineering and other trades. As regards shipbuilding, Messrs. Shanks and Co., of Barrhead, a firm depending largely upon that industry, remind the *Express* that in Germany all goods required for shipbuilding enter free of duty. Under a protective system Germany found it impossible to build ships, and was forced to adopt Free Trade, yet the *Express* would handicap us as Germany was handicapped and cheerfully ruin the industry for the sake of a party triumph. Our engineering exports are now well over £30,000,000 per annum, or over five times the imports.

During the five years ending 1907 the engineering imports increased by a little over *half a million* sterling, whilst the exports in the same time *increased by about* £13,000,000. Comment on these figures is needless; they speak for themselves.

The Horse Show.—We understand that a striking feature of the Horse Show last week was the brilliant manner in which the arena was illuminated by 102 arc lamps of the "Excello" pattern.

E

AN ELECTRICALLY-OPERATED REVERSING COPPER ROLLING MILL.

By DR. ALFRED GRADENWITZ.

Electric power transmission has found extensive scope in connection with the numerous drives of metallurgical works, which frequently operate under the most difficult conditions. While only accessory machines for the handling, crushing and adjusting of the metal were in the beginning adapted to electrical operation, the first instances of driving of rolling trains themselves are of a far more recent date.

Light double and triple trains of constant travelling direction that offer relatively small difficulties to electricians are now designed nearly exclusively for electric operation. Owing, however, to the undoubted advantage to be derived from a complete centralisation of power production, the problem of electrifying the heavy reversible rolling mills which, in modern metallurgical works, are the only plants still equipped with separate steam engines, had soon to be faced. After the electrification of colliery winding engines, in connection with which there are quite similar fluctuations in load, had been satisfactorily dealt with by electrical science, the possibility of designing practical electrical drives also for rolling trains could no longer be doubted.

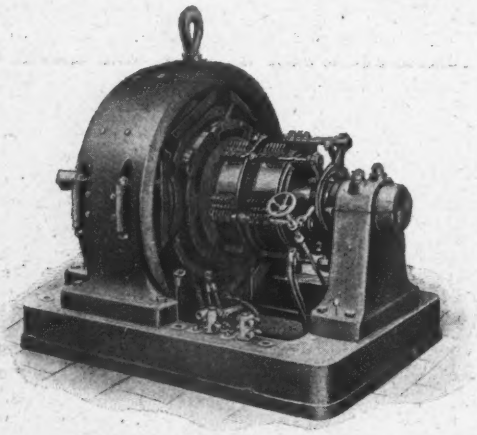


Fig. 1.—Dynamo for Ward-Leonard Drive.

In fact, the satisfactory results obtained in connection with those reversing rolling mills which have been electrified of recent years, strikingly prove the advantages afforded by electrical operation also in this special field in which the steam engine formerly reigned supreme.

It is proposed in the following article to describe some features of electric operation in connection with the reversing rolling mill of Messrs. G. Zugmayer and Sons, at Waldegg, Lower Austria, which have been recently installed by the Austrian Siemens-Schuckert Works.

The rolling train is intended for working copper plates of up to 3 tons in weight, which are used in the making of heavy pans and boilers, and especially locomotive fire boxes.

The rolling mill, which formerly ran in a constant direction, was previously operated by a water-wheel. When, however, a hydro-electric power plant of 200 H.P. was installed for the production of electrical energy for light and power, the managers of the works decided on electrifying also the rolling train, which, at the same time, was equipped with new rollers ·86 m. in diameter and 3·20 m. in length. In order to dispense with elevators (which, owing to the heavy weight of the ingots, would have been rather expensive), and to accelerate the operation of the mill, a reversible drive on the Ward-Leonard system was used.

The train is operated by a constantly excited direct-current shunt motor, which derives its armature current from a shunt dynamo intended exclusively for rolling-mill operation. By altering or reversing the exciting current of this dynamo, the voltage supplied to the rolling-mill motor can be varied between positive and negative limits, thus controlling the speed of the motor in both directions in small steps and practically without any loss. This, owing to the low intensity of the exciting current, is achieved by a simple small regulating resistance, operated without any difficulty. In order to ensure sparkless commutation in spite of the rapid changes in the direction of the armature current and the heavy load fluctuations, both the dynamo and the rolling-mill motor have been provided with commutating poles and compensating coils (figs. 1 and 2).

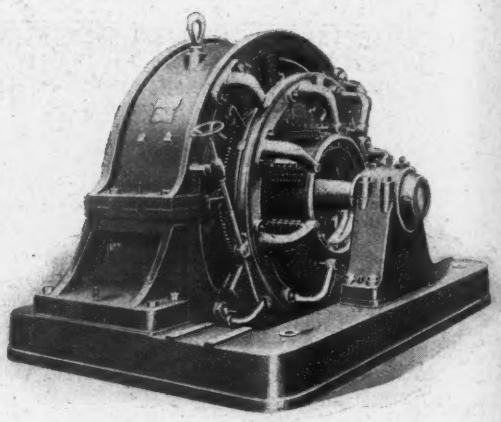


Fig. 2.—Rolling-Mill Motor.

The rolling-mill dynamo, together with the current generator for the numerous minor motors of the works, is operated through belt transmission from a turbine of 160 H.P. Between the two dynamos is arranged a cast-steel fly-wheel 5 tons in weight, travelling at 780 R.P.M. with a circumferential speed of about 94 m. per second. In addition to this machine, the power station contains a special lighting current dynamo, operated by a 40-H.P. turbine, which at the same time supples the current for exciting the rolling-mill motor.

The works dynamo (visible to the left of the fly-wheel in fig. 3) requires to drive it about 60 H.P., thus leaving a surplus of only about 100 H.P. of the turbine output for the operation of the rolling mill. Now the operation of the latter, in the case of heavy passes, requires up to 1,500 H.P. on the shaft of the dynamo.

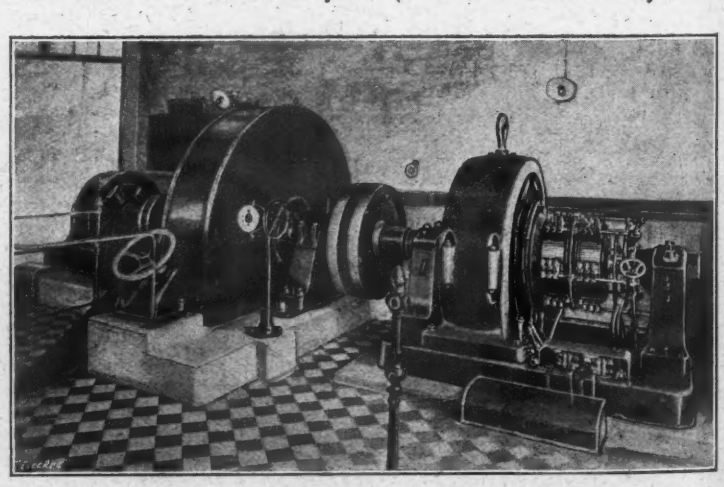


Fig. 3.—Generating Plant.

The deficiency of about 1,400 H.P. is supplied—though only for a few seconds—by the fly-wheel, a decrease of about 15 per cent. in the speed being sufficient to obtain this effect. This decrease in speed is adjusted for automatically,

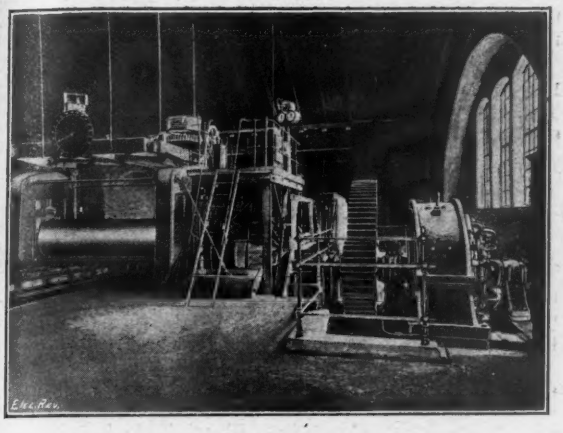


FIG. 4.—MOTOR DRIVING ROLLING-MILL.

the turbine assuming of its own accord a lower speed of rotation in the case of overloads, while the guide vanes are opened completely by a regulator. A patented automatic pressure regulator (designed on the Dick system) keeps the voltage of the works dynamo practically constant, in spite of heavy fluctuations in the speed.

From the switchboard in the power station the current is supplied through underground cables to the rolling-mill motor, installed at about 200 m. distance. With a view to compensating for the drop in pressure occurring in the transmission line, the dynamo is designed for 600 volts and the rolling-mill motor for 550 volts.

The maximum output the motor is called upon to yield is about 1,100 H.P., which corresponds to a torque of 7,900 mkg., at a speed of about 100 R.P.M. However, the torque yielded by the rolls is about five times as great, toothed wheel gearing with a ratio of 5 : 1 being inserted between the motor and the lower roll (fig. 4).

The pinion is mounted on an extension of the motor shaft between two bearings, which ensures a very compact design of the whole drive. The peculiar form of the motor-housing foundation frame and the three bearings was determined by special local conditions.

The rolling speed at the maximum armature voltage is about ·9 m. per second, which can be increased up to 1·1 m. per second by weakening the field of the rolling motor and reducing the torque in proportion.

The regulating resistance which, as explained above, serves to control the motor, is arranged on an elevated platform, whence the metal coming from the furnace can be readily watched. By moving a vertical controlling lever forward or backward, the plate located between the rolls is moved in a corresponding direction, at a speed depending on the distance the lever has been moved from its central position. By pulling it back rapidly towards its position of rest, the drive is stopped immediately.

A special patented arrangement of connections causes the rolls immediately to follow any motion of the controlling lever, thus enabling the operator to control the rolling mill with a safety quite unattainable in connection with steam engine operation.

A smaller controller, visible in fig. 4 to the left of the main controller, serves to control the driving motor for the adjustment of the rolls. In front of the operator's stand is situated a column with current and pressure meters for the rolling-mill motor, and a long-distance dial allowing the fluctuations in the speed of revolution of the fly-wheel to be watched.

The hopes attached to the electrification of the rolling mill have come true in every respect. The considerable number of accessory operators that was formerly required for lifting the heavy ingots has been greatly reduced, while accelerating the rolling operation to such an extent as to increase materially the total output, in spite of the fact that night shifts are dispensed with. A material saving in coal has also been obtained, the furnace for heating the copper ingots being operated only by day. In consequence of the great improvement in the handling of the drive, it is now possible readily to perform on the roller train duties (such as the production of sheets of graduated thickness) which formerly were either impossible, or possible only at considerable expense, and with great difficulty.

The installation of the hydro-electric power plant has resulted also in much further saving, a number of old and uneconomical steam engines used to operate some accessory drives having been replaced by electromotors, thus restricting the use of coal exclusively to furnace heating.

Another interesting rolling-mill drive is in course of installation at the Royal Hungarian Iron and Steel Works, of Diosgyör. The motor used in this connection is represented in fig. 5; it is designed with a single armature for a maximum output of 12,000 H.P., and the dynamo, which is operated by a 1,800-H.P. three-phase motor, is fitted with two cast-steel fly-wheels of 70 tons total weight, serving to compensate for fluctuations of load.

This remarkable plant is likewise being installed by the Austrian Siemens-Schuckert Works.

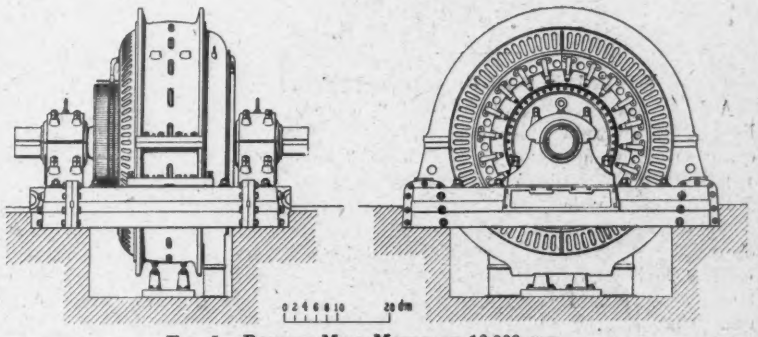


FIG. 5.—ROLLING-MILL MOTOR OF 12,000 H.P.

AUTO-TRANSFORMERS FOR METALLIC-FILAMENT LAMPS.

BY J. L. CATEAUX, A.M.I.E.E.

SUPPLEMENTING my article in the ELECTRICAL REVIEW of October 16th, 1908, I think it desirable to call attention to certain matters of detail which, if carefully attended to, will ensure the best and most economical results with low-voltage installations.

Owing to the supply pressure being usually slightly higher than the declared voltage, especially at times of light load, it has become fairly common practice to use 105-volt lamps on 100-volt circuits and 210-volt lamps on 200-volt circuits, but it does not appear to be generally understood that a similar precaution is just as necessary for low-voltage lamps with auto-transformers. The transformer should, therefore, in most cases be wound for a supply voltage 5 per cent. above the normal, unless in some few cases it is known that the supply is never above the normal.

The regulation of the transformer itself also has an important bearing on this point, and I consider that in properly-designed apparatus it should not exceed 4 per cent. to 6 per cent. over-all (the higher figure in the smallest sizes only), but unfortunately this point is frequently sacrificed for the sake of cheapness, and it is quite common to find the regulation no better than 10 per cent., or even more. Assuming it to be 10 per cent., this means that the lamp voltage will probably be 5 per cent. high at light load and

5 per cent. low at full load, so that if the supply pressure is 5 per cent. high at times, it follows that the lamps may be overrun as much as 10 per cent. when only a few are in use at a time.

It is a common error to suppose that 2 or 3 volts overrunning will not matter; it is entirely a question of percentage, and 2 volts extra on 25 has just the same effect upon the lamps as 8 volts extra on 100. Even if trouble is not experienced by the blackening of the bulbs, the life of the lamps must necessarily be materially shorter than if they are burned at their correct voltage.

A point which is often overlooked in low-voltage installations is the advisability of using a certain percentage of carbon-filament lamps in places where light is only required intermittently and for short periods—as, for instance, in lavatories, cellars, storerooms, attics, &c.

It is useless to put comparatively expensive metal-filament lamps where the hours of burning per annum are so small that the saving in current is a negligible quantity, and the lamps cannot possibly pay for their higher first cost. Carbon-filament lamps for 25 volts and 50 volts are quite easily obtainable, and a judicious combination of carbon and metal-filament lamps—placing the metal-filament lamps in the long-burning positions—will give the lowest first cost and the lowest annual cost for renewals and current consumption.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

E.M.F. in a Dead Underground Cable.

A dangerous voltage is often "found" in E.H.T. overhead lines (even on lines which are new and have never been charged) by the unfortunate lineman or jointer who does not take the precaution of earthing them before handling. As regards E.M.F. in dead low-voltage underground cables, I have often observed this, and the cause in every instance was due to surface leakage, either at the link box over the top of the compound, or over the surface of the slate panel of a feeder pillar, &c. I think, however, that Mr. Williams is talking nonsense.

A. J. Abraham,
Electrical Engineer, Lanark County Council.

Cambuslang, *June 12th*, 1909.

Engineer's Department v. Accountant's Department.

What a hornet's nest I have put my head into, and as you state that "several letters have been received too late for insertion," there's more to follow. My letter "spells jealousy throughout!" If "Quid Nunc" or anyone else think that to be the case, they are quite welcome to the idea, but if they will read the last two paragraphs of "Interested's" article, I think they will at least admit that my letter is at the worst a case of the kettle calling the pan "black face."

I certainly do not agree with "Quid Nunc" that it is in order to enter a payment on the Dr. side of the creditor's account *after* certification for payment but *before* payment. My common sense may tell me that there is an entry on the credit side of that account, but I was not referring to the Cr. side of that account at all, but to the Cr. of the cash book. Had my ready critic known anything about book-keeping his common sense should have taught him that. I agree that common sense is particularly useful at times, but it is much more useful when accompanied by knowledge and experience. If the account were not passed for payment, a correction might certainly be made by crediting the creditor's account and debiting an impersonal account; but I think that few accountants who know their business would keep their books in this manner.

To an accountant the article of "Interested" is quite understandable, though it cannot be accepted as a full statement of the case, nor do I think it was intended to be. As a matter of fact, I should not have replied at all had not "Interested" chuckled over the "howlers" of his accountancy friends, and had not his letter, *prima facie*, bore evidence that ignorance of the work of the other department was not confined to the accountant. Nor do I think that "Quid Nunc" helps him very much; but perhaps he, too, has only partly explained his case.

"Interested" has retired very early from the fray; but perhaps he is saving it up for the Institute of Municipal Treasurers and Accountants. Poor fellows! Make 'em squirm, "Interested."

Accountant.

Municipal Trading and the Electric Lighting Acts (Amendments) Bill.

The article appearing in your issue of the 4th inst. under the above heading by a "Borough Electrical Engineer," purporting to show the municipal side of the question, will be hailed with delight by all opponents of municipal trading. The fallacy of the arguments advanced gives a better idea of the hopelessly weak position in this matter of the supporters of municipal trading than any article written by an opponent could hope to do.

His view of the financial side of the question, coming as it does from a borough engineer, is instructive, though it can scarcely be regarded as encouraging to the ratepayers. Speaking generally of the wiring department of a municipal undertaking, he says: "It cannot very well cost more than 1d. rate." Seeing that the rateable value of London is over £44,000,000, this 1d. rate would be equivalent to more than £180,000 per annum for London alone. Let us, however, take the case of a single London borough possessing an electrical undertaking, and with a rateable value of £1,950,000. The 1d. rate in this case would be equivalent to over £8,000 per annum. If we assume that the average loss made by a municipal wiring department does not exceed 10 per cent. (an assumption with which the writer of the article will scarcely quarrel), the amount of work to be carried out annually would be about £80,000, and by this amount the annual turnover of the local contractors would be diminished. And yet the money value of the damage done to the contractors is put by your correspondent at 4s. 2d. each (just $1 a head), this amount being arrived at by assuming the average rating of a contractor at the absurdly inadequate figure of £50, and assessing the damage caused at the amount by which his rates are increased to cover the loss of the municipal wiring department.

This is really delightful. According to this view, it would appear that if a footpad (no offence is intended by the simile), after taking toll of a man's purse, inflicts such grievous bodily harm upon him as to render him incapable of earning his living, the extent of the damage is exactly represented by the amount of the cash taken, and should no money be taken, then the damage is nil. The mere fact that the unfortunate man may be compelled to spend the rest of his life in the workhouse (an additional burden on the ratepayers) does not apparently enter into the calculation.

What benefit the writer of the article expects the general body of ratepayers to gain in exchange for the annual loss of £8,000, accompanied, as it must be, by very serious financial loss to such of their fellow ratepayers as are unfortunate enough to be electrical contractors, it is difficult to see, and on this point he is wisely silent.

Contractor.

London, *June 8th*, 1909.

I was interested in reading the article on the above subject by a "Borough Electrical Engineer." There are one or two things that he does not make very clear. He talks of a contractor never being called upon to the extent of above 1d. rate for the deficiency in the wiring department. He has evidently overlooked the fact that a 1d. rate loss is equal, in many instances, to the turnover of some contractors, and what about the orders the contractors are done out of? Had the supply department not been in competition for the work the contractors in the town would have had more

orders, hence a better chance of making a living, which is almost impossible while these engineers are dabbling in contractors' work. If some of these engineers who have their bread buttered for them were put in a contractor's place for a year or so, I do not think we should hear much about municipal trading, apart from the supplying of energy.

Electrical Contractor.

June 8th, 1909.

Electricity in the Home.

Oh! "Maud!"

How do you know so much about the luxury of a shave in the light of an 8-c.p. lamp on a universal bracket? And why do you only hint at the use of an apparatus for such as "a milk boiler for baby"? Did you not intend to describe the luxury after a shave?

If you are the "inferior half," "the mere man," disguised under your *nom de plume*, how then do you come to know so much concerning the servants' quarters and kitchen? Either way, I am afraid you are a sad case. One can readily imagine that, in answer to your invitation, you will be besieged by many members of the fair sex all anxious for you to describe to them particulars regarding those "further anythings" that you have not yet made clear "concerning the application of the most useful of Nature's forces ever known to mankind."

"Maud," do be careful, or you may find yourself in deep waters with the gas man.

B. T. Unit.

[We hasten to assure our facetious correspondent, on behalf of our esteemed contributor whose identity is concealed under the feminine pseudonym of "Maud," that his apprehensions are unfounded. We know of "Ladies' Columns" in the lay Press which are edited by males; but neither we nor our contributors are possessed of the colossal presumption required to emulate such feats. "Maud" is genuine.—Eds. E.R.]

Mercury Motor Meters.

The explanation of "Strebor's" difficulty is, I think, quite simple. A meter passes the test room all right, but starts badly when erected outside. A particle of dust in the mercury chamber might, in the carrying of the meter to the installation, get lodged in a place that would cause considerable friction with the moving part. On bringing the meter in again, the particle would shift again, and the meter appear all right in the test room. Impurities in the mercury chamber lead at times to the most erratic results.

With regard to "Mercurio's" remarks as to the effect of overload on mercury motor-meters, I have had two mercury meters working continuously for three years on 100 per cent. overload without any trouble. I have known only three cases of explosion in the mercury chamber. I put it down to a short circuit vaporising the mercury, and the resulting pressure in the chamber, not being quickly enough relieved through the chamber closing device, blows mercury through the joints, and damages the revolving part.

R.

Mining Switchgear.

Referring to Mr. W. R. Burge's letter, dated May 29th, my own experience in this matter would lead me to say that it would be exceedingly difficult to design gauze ventilation windows such as he suggests with sufficient mechanical strength to meet the interpretation that most mines' inspectors are placing upon Rule 37, Sec. 5, of the official copy of the Home Office Regulations (1907 reprint). The fact of the matter seems to be that no one really knows at the present time authoritatively how this clause should be interpreted, and the consequence is that where machinery is installed under guarantees to meet this clause, the contractor places himself under obligations to meet the ideas of the particular mining inspector of the district where the plant is to work, the consequent risk of rejection being considerable. It seems to me that the clause altogether omits to take into account the use of squirrel-cage motors in mines, which type is so largely adopted at the present time. This class of motor of the semi-enclosed type as now made would appear to be about as safe a machine as it is possible to manufacture, without any attempt to render it flame-proof by partial or total enclosure.

It is, I think, generally agreed that it is next door to an impossibility to make a piece of revolving machinery like an electric motor absolutely gas-tight, and, in my own experience, machines fitted with gauze grids are objectionable in that the interstices of these, as well as the space between the layers of gauze, get filled up with coal dust and other material, thus impeding the ventilation and sooner or later causing the burning-out of the machine if it is anything like fully loaded.

In view of the fact that at the present time it is left to the inspector of each district to take his own particular view of what degree of mechanical strength will meet the rule for enclosure of machines coming under this section, an authoritative pronouncement on the subject by the Home Office seems to be urgently needed, as at the present time there is no doubt that the electrical industry is suffering in its mining work from the doubt which exists as to the law on this subject. To show the extent to which this doubt exists, I may say that to my knowledge more than one manufacturing firm is at the present time refusing to quote for electrical machinery to meet this section until a clearer interpretation is obtained of the requirements of this Act.

The clause also acts unfairly upon those coalmasters who, in their desire to protect their men to the greatest possible extent, use safety lamps in pits where Rule No. 8 of the Coal Mines Regulation Act does not apply, and where no gas is present. Here in Scotland, at any rate, it would appear that the moment a safety lamp is used this is considered sufficient justification for insistence upon the enclosure of electrical machinery to meet the above-mentioned Rule 37.

I should like to see this matter much more thoroughly thrashed out than it has been up to the present time, and trust that it may not be allowed to rest in the present unsatisfactory position.

C. Atherton Atchley.

Glasgow, *June 9th*, 1909.

As manufacturers of switchgear for mines, we are very much interested in the discussion which is at present proceeding in your columns, and with special reference to Mr. W. S. Burge's letter in your issue of last week, we would point out that the proposal to construct a switch with wire gauze ventilation has already been tried and found wanting. (See recent I.E.E. paper on "Electricity in Mines," by Mr. Simon.)

After making an extended series of experiments, we have come to the conclusion that the only safe course is to arrange boxes with long metal-to-metal machined joints, and we should be happy to demonstrate the absolute safety of the system which we use to any mining engineer who is interested.

A. Reyrolle & Co., Ltd.

Hebburn-on-Tyne, *June 10th*, 1909.

The Electrical Industry and Tariff Reform.

My friend Mr. Rich has chosen an unfortunate instance to support his advocacy of a "moderate tariff" on imports.

On his own showing, the moderate tariffs of our Colonies have not stopped the importation of German electrical motors, lamps and accessories, and for many years the German firm carried on an important business in France while the tariff was moderate; now that the French tariff is prohibitive, or "reactionary," as Mr. Rich calls it, internal competition keeps French selling prices down to the German and English level, and the German firm is starting a factory in France to employ 400 to 1,000 workpeople to further increase the internal competition and so depress prices further.

In our own free market, where electrical manufacturers are free to purchase in the world's market, internal competition,

largely due to factories erected here some years ago by German and American firms, has kept selling prices at a very low level. With the French experience that even a prohibitive tariff does not raise prices, what inducement is there for us to part with our liberty of purchase? Importation will cease of itself wherever the home manufacturer can compete in price.

Taxation of imports can, of course, reduce foreign trade or exchange of commodities, but it does not create employment. When import taxes are sufficiently high to prohibit or to check the importation of certain commodities, a temporary rise of price results, until native and foreign capital, attracted by the higher price in the protected trade, provide factories and transfer labour from less favoured industries; but the protective effect vanishes when the increase of such internal competition brings prices down to the level prevailing in free markets. In the long run, Protection is only valuable to manufacturers who succeed, in the absence of foreign competition, in forming trusts to limit internal competition, and thus maintain artificially high prices.

Artificially high prices mean reduced consumption, and therefore less work.

The expansion of German industry is largely due to the abolition of tariffs between the different sections of the United Empire; and internal Free Trade similarly prevails over the huge territory of the United States.

In cases where fashion or other than competitive reasons determine the choice, a moderate tariff is ineffective; many Americans buy English clothes, French motor-cars, &c., despite the very high or "reactionary" tariff; and if it is correct that the electric train equipment which Mr. Rich refers to could have been bought here as advantageously as it was bought in Germany, probably other considerations but price determined the order; if so, a moderate tariff would probably make no difference.

The occupations of the vast majority of our people are not subject directly to foreign competition; it is only a small minority who can possibly be advantaged by restricting importation of foreign goods. Even from the selfish standpoint of the industries who desire such protection, the advantage is likely to be temporary; while the loss of liberty to purchase in the world's market would be permanent for he whole nation.

Foreign and Colonial Governments doubtless find it politically convenient to raise revenue by the wasteful but indirect method of taxation of foreign imports, viz., by tariffs that are not effective in stopping the importation of foreign goods; and this is the real reason why we alone among the great nations have liberated ourselves from Protection and substituted taxation for revenue.

Free Traders are no theorists blind to facts; they are mostly business men who consider the favouring of a few selected industries at the expense of the community to be thoroughly bad business, and men who desire to keep business free from political interference.

Erith Engineering Co., Ltd.,
CHARLES ERITH, *Director.*

London, E.C., *June 14th*, 1909.

Like Mr. Rich in his letter of the 7th inst., I have been taking an interest in the correspondence in your pages and those of the *Daily Express* on this question.

Now Mr. Rich is unfortunately like all and sundry of those who seek by specious statements to support a cause which has no sound economical basis for its foundation.

It has been pointed out in your columns on more than one occasion that the economical basis of trade cannot be illustrated by singling out any one particular trade, or any particular firm of that trade, yet this is the invariable method of proof adopted by the Tariff Reformers to support their contentions.

But, on the other hand, I will refer Mr. Rich to the official statistics published by the Board of Trade, in which he will find that the manufactured exported goods of this country are greatly in excess of those imported, and this being the case the employment of labour must be greater for the former than the labour which is displaced by the latter. I, therefore, am justified in saying that the theory and facts associated with such practice are of far more value than the suppositions that are to be founded upon such single instances as are given by Mr. Rich.

We as Britons can point out many instances of firms from abroad who came over here and who were going to show us poor, dilapidated, crushed, out-of-date Englishlanders how to manage our business, and we are very much obliged for the lessons; they are not to be emulated, and we prefer our own firm methods of finance and manufacture.

The Englishman's home is not yet full of foreign materials, with soldiers practising on the grand piano, although some of our more ardent patriots would have us believe it.

Will you allow me to point out to Mr. Rich that the imports of all protective countries are, and must be, greater than the exports, excepting in the case of those countries who are large borrowers and contract financial loans of an extensive nature? And certainly, in all industrial countries who found their foreign business on a sound financial basis, the imports must exceed the exports. There is no exception to this, and no one who is capable of grasping the science and practice of commerce would for one moment endeavour to maintain the contrary.

There is only one remedy that can in any way stop imports, and that is, to stop exporting, or what amounts to the same thing in practice, namely, tax your imports and kill your exports.

And anyone who would contend that a local and insular trade is of greater benefit to any country than a combined local and foreign trade, ought to go to a night school for political economy.

John I. Hall.

London, W.C., *June 11th*, 1909.

Rope Factories.

Could any of your readers furnish general information on hemp rope factories, stating, for example, if individual drive is largely adopted, ratio of maximum demand to H.P. installed, approximate load factor, number of units used per ton of rope produced, and approximate size of installation?

Ubique.

Future Prospects in the Electrical Industry.

Will some of our more experienced readers, for the benefit of juniors, kindly inform us whether they anticipate any prospect in future of things not only getting better, but much better? A few incidents which I have been carefully watching cause me in all seriousness to ask the question, "Is the game worth while?" or is it best to seek pastures new—for this seems to be the case amongst some, and if the facts were only known, perhaps amongst a good many.

Three friends of mine some 12 months ago unfortunately lost their positions; two were engaged in the manufacturing departments, and one in a central station. The former were discharged as a result of slackness in trade; the latter through illness, not being able to resume his duties in six weeks. After some time one of the former was successful in getting an appointment, but the other two are still out; disgusted, they intend going abroad, and are determined to take anything which comes along, for, as most of us know, this can only be done in a new country. I have met several young fellows who would not be afraid to take off their jackets at anything in return for a reasonable salary, nor do I see where the hardship comes in, say, for those up to the age of 21, but for those who have passed their 25th birthday it's "a bit rough"; again, I know of a large station which discharged a great number of its hands when metallic-filament lamps came on the market. I wonder how they have fared, and are they all in positions again?

For my own part, I suppose I am very fortunate—at least, judging from some of the others. I have been grinding and hoping for this past five years—two years central stations, seven days a week of eight-hour shifts; it is only fair to add, I have been taking charge of my shift. But

are we to keep listening to the old tale: "Shut your eyes and open your mouth to see what God will send you"—then, after all, find ourselves in a bunker? Leaving the salary question out of the matter, for we are all well aware how things lie in that direction, are our prospects at stake also?

Junior.

A Curious Telephone Freak.

A somewhat curious incident has just taken place here on a small installation of telephones which we have, for which I am quite unable to account. Perhaps some of your readers may have experienced something of the same kind.

Some days ago a violent thunderstorm passed over here during the afternoon, and, as far as I can remember, the telephones were in order that evening; lightning continued intermittently all night, but at a great distance. The following morning all the instruments refused to work (that is, to ring, as we could speak plainly), and continued so for two whole days and nights. Suddenly, on the third morning, they recommenced work. The instruments, which have arresters, are interconnected, as we have no central exchange.

No bells were heard ringing, nor was any disturbance noticed, during the storm. All lines and earths are and were absolutely intact. I should be very interested to hear if this is a common occurrence.

Charles Dudding,
Engineer and Assistant Manager,
Anglo Greek Magnesite Co., Ltd.

Limni, Greece, *June 4th*, 1909.

[A diagram of connections would have greatly assisted in solving the problem. The question also arises whether battery or magneto ringing was employed, as quite different conditions prevail in the two cases.—Eds. E.R.]

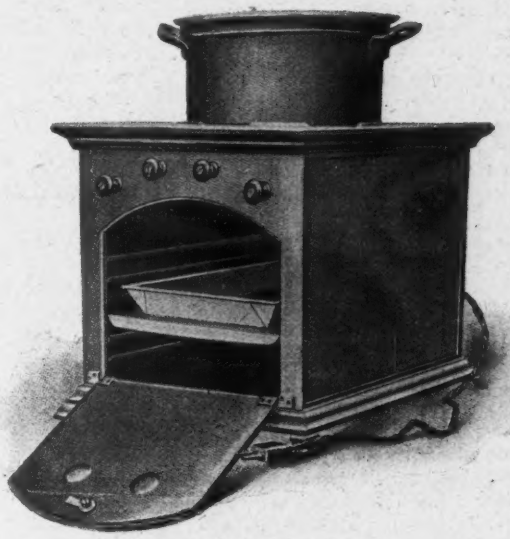
ELECTRIC OVENS FOR HIRING PURPOSES.

Some little time ago a mild sensation was created in the electrical press by the news that Mr. Chas. Furness, the borough electrical and tramways engineer of Blackpool, had decided to take the "bull by the horns," and initiate an electrical cooker hiring scheme in his area of supply. We understand that up to the present no very definite scheme has yet been put into operation, but experiments have been proceeding for some time with electrical cooking apparatus, and the conclusion has been arrived at that electrical cooking at 1d. per unit of electricity can compare with the cooking by domestic gas ranges at 2s. 6d. per 1,000 cb. ft. One of the most efficient ovens that has been tested at Blackpool was supplied by Mr. C. Fonteyn, of 76, Newman Street, Oxford Street, London, W., and in one of these ovens very efficient and satisfactory results were obtained, with the result that a hiring scheme will shortly be formulated at a rental of 3s. to 4s. per quarter. Should this rental be found insufficient to cover interest and maintenance charges, Mr. Furness will be quite content to make up the difference out of the charge for current, as he is not anxious to make any profit for the first 18 months on this scheme; he rightly takes the position that electric cooking must have a start somewhere, and that it would be a mistake to seek profits at this juncture by fixing prohibitive rentals.

It may, therefore, be interesting to note that the "Radiant" apparatus, which has been received with favour at Blackpool, has been the subject of a considerable amount of testing during the last year or two. At Guildford it was found that one of these cooking stoves cooked ordinary household materials at slightly under the cost of cooking the same class of work by gas, placing the price at 1½d. per unit. Mr. A. R. Sillar, of Colchester, has obtained the following results:—A fowl was roasted a little overdone in 35 minutes; a 3-lb. small joint was cooked in 30 minutes, and pastry took 17 minutes.

Mr. S. E. Britton, the borough electrical engineer of Chester, reported that with this oven a loin of lamb was cooked in 1 hour 15 minutes, for a consumption of 1·25 units, while one of the tests at Blackpool showed that a sirloin joint of 6 lb. was cooked in 1 hour for a consumption of 1·1 units, a vegetable being placed in the pan at the top of the oven, this being also cooked along with the meat. Our illustration shows the type of oven which is fitted for the above purpose. Its size is 13 in. × 14 in. × 15 in., constructed of galvanised iron, so that rough usage will not affect it, the lamps for roasting being fixed at the top of the oven, so that it is impossible to damage them. In addition, there are three extra lamps fitted for grilling, toasting, boiling, &c., and the consumption when using six lamps, is only 900 watts per hour.

It may be interesting to note that Mr. Fonteyn will very shortly put on the market an oven which will cook a full-sized dinner sufficient for any number of persons up to six or nine. It will perform every culinary operation, such as roasting, baking, toasting, boiling and grilling. There will be an oven for the roasting, baking and grilling, and auxiliary apparatus sufficient to boil five separate saucepans. So far as corporations and supply companies go, it is probable that this oven can be sold to them at about six pounds, and for an oven of this type made of cast-iron, enamelled inside and out, it should be very substantial and of good appearance. There will be about 20 lamps in the new oven, but it will scarcely ever be necessary to have all the lamps going, inasmuch as it is very exceptional to be baking and roasting



"Radiant" Electric Oven.

at the same time, nor is it necessary to have all the boilers going. Every lamp is guaranteed for 1,000 hours, and should any lamp fail electrically within that time, it will be replaced free of charge. It therefore seems as if electric cooking is at last getting on to a commercial basis, and it will be interesting as time goes on to note the progress made by this new departure. There is no doubt that the great trouble up to the present in electric cooking has not been the unwillingness of the public to attempt a new experiment, especially in cases where in small households the lady of the house does her own cooking, but rather that electricity supply authorities have adopted a very conservative and cautious attitude with regard to this feature, which was, to some extent, justified by the rather high price which has hitherto characterised electric ovens.

LEGAL.

Gould v. Lewhess.

In the Court of Appeal on Saturday last, before Lord Justice Fletcher Moulton and Lord Justice Buckley, Mr. Gore-Browne, K.C., moved in the case of Charles A. Gould *v.* Edward E. Lewhess for a stay of execution pending the hearing of an appeal. The action in which judgment was given by the Court below related to a transaction in batteries used for electric omnibuses (see Electrical Review).

Mr. Gore-Browne said that the sum at stake was a large one, and he was asking for a stay of execution without bringing the money into Court. The action was in relation to the sale of certain batteries used for electric omnibuses, which it was agreed should be paid for subject to certain tests. It was said that the tests did not take place owing to the defendant having prevented them, and, therefore, for all the purposes of the transaction they must be regarded as having taken place, and a third party with whom an arrangement had been made not having carried out the arrangement. By buying the batteries the defendants became liable. The only question was whether the amount of the damages should not be something less than £2,500. One of the plaintiff's witnesses was named Pratt, and in his cross-examination he said that the value of each of the batteries, taken as at a forced sale, was £230 if sold for electrical purposes. There were 15 batteries consisting of from 42 to 48 cells each.

Lord Fletcher Moulton: How has the learned judge estimated the value?

Mr. Gore-Browne said that he had given the full price less £20 The value of the materials themselves, apart from the use to which they were put in the batteries, might be about £1,500. That would be the full value.

Lord Justice Fletcher Moulton: Are you prepared to bring anything into Court?

Mr. Gore-Browne: Yes. If they will allow me the £1,500 I will bring in the whole amount.

Mr. Atkin, K.C., for the respondent, said that the case was founded upon alleged fraudulent misrepresentation. The batteries were hired out to a company—an Electric Omnibus Co.—for three years. It was alleged that possession of the batteries had been obtained by fraudulent misrepresentation. The batteries were now in the possession of the Omnibus Co. and could not be demanded for another 18 months. One of the experts called on the other side said that they were worthless and had been scrapped, that they were not in use. He was called to say that they had never passed the particular test. Then there was the further fact that being on the scrap heap there was no power to recover them for 18 months. He did not know how the matter came before their Lordships in the way of appeal, because the learned Judge had given a stay upon terms. The learned counsel added:—"I really do not know what they are appealing about. These gentlemen are gentlemen of position, and having obtained judgment they naturally desire to have the fruits of their success secured to them. There is no reason for dealing with the exercise of the judge's discretion."

Mr. Gore-Browne said that the only terms given to him were the terms of bringing the whole of the money into court, and it was a large amount. He could not, however, dispute that unless he said that the learned judge's decision on other matters was wrong. The expression "scrapped" did not mean that they had been broken up. It only meant that they were standing on the shelf, not being any longer used, because it had been found that other batteries were more suitable and did the work better. He asked for a stay of execution until the hearing of the appeal on bringing £1,300 into court.

Lord Justice Buckley said that the learned judge had granted a stay of execution on certain terms, and the Court would not interfere to alter that decision except upon a very plain case. The application must be refused.

Judgment accordingly.

Benett-Stanford v. the Warminster Motor Co., Ltd.

In this matter, tried at Salisbury County Court on June 10th, a case in which Mr. J. M. Benett-Stanford claimed £100 damages for alleged negligent workmanship in connection with the installation of an electric lighting plant at Hatch House, Tisbury, Mr. Hugh Sturgess, barrister-at-law, applied for the reference of the details of the case to an expert. Mr. Titley, solicitor, of Bath, who appeared for the defendant company, supported the application.

The Judge: Are you agreed as to the expert?

Mr. Titley: We hope to agree, but if not to apply to the Court.

The Deputy-Judge ordered the documents to be referred to an arbitrator, to report to the Court.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Siemens Continuous-Current Motors and Generators.

The following are some particulars of a new class of continuous-current machines recently designed and placed on the market by Messrs. Siemens Bros.' Dynamo Works, Ltd. These machines are made in three types, viz., protected, ventilated, and totally enclosed. Fig. 1 shows a standard protected-type machine, and fig. 2 the ventilated type. The latter is shown with perforated

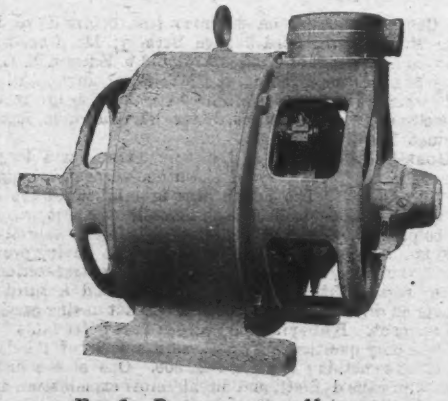


Fig. 1.—Protected-type Machine.

metal covers, but single or double gauze covers are fitted when required. The totally enclosed type is similar to the ventilated type, with the exception that the covers are of solid instead of perforated metal.

The machines are capable of dealing with 25 per cent. overload for half an hour, or 40 per cent. overload for three minutes, without undue sparking or overheating. For continuous running, the temperature rise, as measured by thermometer, does not exceed 70° F. for protected-type machines, 80° F. for the ventilated type with perforated metal covers, and 90° F. in the case of the ventilated type with gauze covers or totally enclosed machines. All the machines are designed to run at all loads with fixed position of brushes. The magnet frame, which is circular and of cast-iron, is fitted with end shields which can be turned through an angle of 90° or 180°, thus rendering the machine equally suitable for fixing to the floor, wall or ceiling. The main poles are laminated and bolted to the frame; commutation poles, when fitted, are of solid wrought-iron in the smaller sizes, and laminated in the larger sizes. The armature is slotted and drum

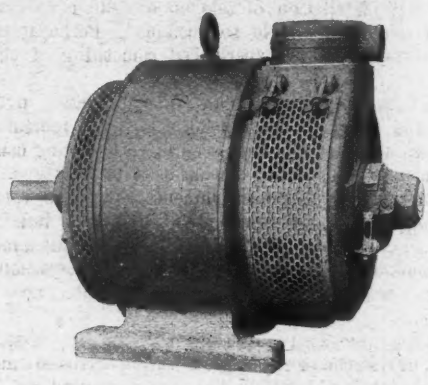


Fig. 2.—Ventilated-type Machine.

wound; the core plates are keyed direct to the shaft, and are held in position by two end flanges. Particular attention has been paid in the design to securing thorough ventilation. The field coils are former wound for the smaller machines, and wound on bobbins in the larger sizes; in all cases they are heavily insulated from the poles and the frame, as a safeguard against earthing by abrasion. Each brush-holder is provided with two brushes. A considerable number of these machines have already been installed to perform widely differing duties, for which they have been found to be eminently suitable. Particulars and prices are given in List 1 B of continuous-current motors, which we have just received.

Automatic Switch.

Mr. L. T. Stone, of The Cottage, Bennett Park, Blackheath, S.E., has secured provisional protection for an automatic switch to cut off the primary of a transformer when the load on the secondary falls below a predetermined value; the accompanying illustrations show the device as applied to an auto-transformer and to a transformer in a sub-station. In the former case, fig. 3, one terminal of the alternating supply is connected to a coil A, the other terminal of which is joined to the lamp a and switch b, whence a connection runs to the intermediate terminal b_1 of the auto-transformer B. The same supply terminal is also connected through a main switch D to one terminal b_2 of the auto-transformer. The auxiliary

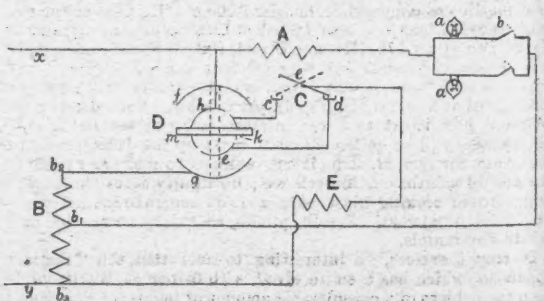


Fig. 3.—Connections of Switch with Auto-Transformer.

switch C is actuated by the coil A, and is diagrammatically shown as of the mercury cup type. A second coil E in series with switch C is connected to the other terminal b_2 of the auto-transformer, and to the other supply terminal y. The coil E actuates the main switch D, connecting the lamps across the transformer.

Switch D consists of six sections, of which f is connected to x and to h (two sections joined together); g is connected to the end b_2 of the auto-transformer; k to one contact c of the switch C and l to the other contact d. The switch arm e is joined to the coil E, and the contact arm m makes the required connections between the contacts of the switch D. The contact arm is operated by a catch on the armature of coil E, which engages in turn four pins suitably placed on the switch, moving the arm through an angle of 90° each time E is energised.

In operation, when one of the switches b is closed to light a lamp, current flows from x through A, the lamp a and switch b, to the point b_1 of the auto-transformer, and so to y through a part

of the transformer which acts as an impedance in series with the lamp, so that the current passing is very small. The coil A being energised, its armature moves and operates the switch C, making contact at c; when this happens, current will flow from x to k, through the arm m to k, through the auxiliary switch C and through E to y.

The armature of E moves the contact arm m into the dotted position, making the circuit from x through m to g and through the transformer to y. The lamp circuit is from x through A to the lamp and switch, and so to the intermediate terminal b_1 of the transformer, the normal mode of connection.

The circuit through E, it will be seen, is broken; the contact arm m now rests on l, in connection with contact d of switch C. When the lamp a is switched off, C acts and coil E is again energised, moving the switch arm m through 90°, and thus leaving the switch D in its original condition.

In fig. 4 an arrangement is shown for use in a sub-station, to cut a transformer out of circuit at times of light load. The action in this case is similar to that above described, but a separate small transformer F is used, connected to a separate source of supply. The secondary of F is connected to the load through the switch D_1;

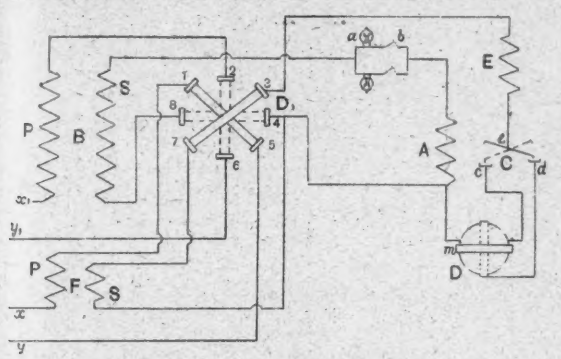


Fig. 4.—Connections in Sub-station.

when a lamp is switched on coil A actuates switch C, and this causes coil E to actuate switches D and D_1, connecting the main transformer B to the load and cutting out F. The latter may be replaced by low-pressure supply from another sub-station. Other arrangements, including an application of the system to a balancing transformer, and another method of controlling a main transformer, are described by the inventor, to whom we must refer those interested for further particulars.

PARLIAMENTARY.

North-East London Railway.

This Bill again came before Mr. Emmott's Select Committee of the House of Commons on Thursday, June 10th. The object is to extend the time limited for the raising of capital for another year, so as to enable the authorised tube railway from the City to Waltham Abbey to be made. At the last hearing before the Whitsuntide recess the consideration was adjourned to enable the promoters to call financial evidence.

Sir Thomas Troubridge, of the firm of Linton Clarke & Co., stockbrokers, was called by Mr. Webb (Parliamentary agent for the promoters), and said he had taken an interest in the project almost from the commencement. The reason why the capital had not been raised was because during the last three or four years it had been impossible to raise money for anything. There had, however, been a considerable change lately, and his own firm had raised more capital in the last two months than in the previous four years. Before he knew the Bill was coming before the Committee he had come to the conclusion that if they got an extension for a year they would be able to raise the capital, for tube railways had been appreciating both in traffics and prices.

The Chairman asked if the witness had any evidence as to the appreciation in tube securities.

Witness handed in a list of prices of the debenture stocks of the London tubes, and also an extract from a recent speech by Sir Edgar Speyer as to the prospects of tube railways.

The Chairman asked how much money they sought to raise?

Mr. Webb said they wished to raise £3,000,000 in shares, of which about £600,000 would be accepted by the contractors. Therefore, the directors had to raise £2,000,000 by the issue of 200,000 shares of £10 each.

The Chairman: Do you think you can do it now?

Sir Thomas Troubridge said he thought they could. He had seen people who had always been with the promoters, and they thought they could.

The Chairman said the Committee were not going to take the responsibility of throwing the Bill out. They would give the promoters their Bill, and hoped they would get the capital.

County of Durham Electric Power Supply Bill.

On Thursday, June 10th, the above Bill came before the Unopposed Bill Committee of the House of Commons.

Mr Fox (Parliamentary agent) stated that the Bill proposed to empower the County of Durham Electric Power Co., the Newcastle-on-Tyne Electric Supply Co., and the Cleveland and Durham Electric Power Co., to enter into agreements for the linking-up of their generating stations, and the sale of electricity to one another. It also proposed to allow the company to lay mains in South Shields for the purpose of supplying energy to the North-Eastern Railway Co. and the Harton Coal Co., Ltd.

Mr. Moon (Speaker's counsel) asked if there were any powers of purchase.

Mr. Fox said there were not, as they were all power companies. The Newcastle Electric Supply Co. had electric lighting powers as well, and an undertaking which was purchasable. There was a clause preserving the rights of the Newcastle Corporation with regard to purchase.

Mr. Chas. Merz, consulting engineer to the companies, gave formal evidence in proof of the preamble. The companies were supplying a large number of collieries in Durham

Mr. Moon: It is an assurance to the consumer to have a linked-up system.

Witness said it was an incidental advantage to the consumer, but he could not say it was necessary technically to have it. Of course, if an accident happened at one generating station it would be possible to continue the supply from another.

Mr. Moon asked witness with reference to the clause in the Bill enabling the company to subscribe for shares or to lend money to any undertaking taking a supply of energy from it, what difference there was between the position of the promoters and a railway company asking power to subscribe to the erection of factories along its line.

Mr. Webb said railway companies had already established businesses, such as hotels, and ran motor services.

Mr. Caldwell (one of the Committee) said he feared that in granting such powers there would be a danger of share capital being used for purposes other than those for which it was ostensibly subscribed.

Witness said that the power of such a concern as theirs to subscribe a small portion of capital to another undertaking made all the difference as to whether it was established or not.

The Committee passed the Bill, but struck out the clause dealing with power to subscribe to other undertakings.

Watford and Edgware Railway and Edgware and Hampstead Railway.

These two Bills came before Mr. Emmott's Select Committee of the House of Commons on Thursday, June 10th, and were considered together.

Mr Cripps, in explaining the Bills, said that the first authorised the construction of a railway from Watford to the present terminus of the Charing Cross, Euston and Hampstead Tube, on the north side of Hampstead Heath. The two Bills were really for the same line, although authorised in two sections. The first proposal was for an extension from Golder's Green to Edgware, and a Bill was promoted in 1902 with that object. But in 1903 a further extension was proposed for running the line to Watford. The object of the Bill now before the Committee was to ask for two years' extension of time for the construction of the works. The Bill of the Edgware and Hampstead Railway was to authorise the deviation of the line originally authorised. They had made an agreement with the Underground Electric Railway Co. for the working of the line. Many of the landowners in the vicinity of the proposed line had agreed to take deferred shares in part payment for the acquisition of their land.

Mr. Steele, Chairman of the company, giving evidence, said that he believed that the district around the proposed line would develop, and they, of course, anticipated a revenue from the persons who would travel from there to the city.

Replying to Mr. Caldwell, a member of the Committee, Witness said that they anticipated a traffic would arise in the district around the railway sufficient to form a revenue for the company.

The Chairman: You have got no big financier at the back of you at present?

Mr. Cripps: No, sir. We hope to put forward figures which will enable us to raise the money from the public, without having to pay dearly for it.

Witness, continuing, said that he estimated the line would cost £600,000, but that did not include rolling stock. That was on the assumption of £100,000 for land and £500,000 for the work. He estimated a gross revenue of £50,000, and he thought the expenses would be a little over 50 per cent.

The preamble having been proved, the Bill was ordered to go forward.

London County Council Tramways.

On Thursday, June 10th, the Select Committee of the House of Commons, presided over by Sir George Doughty, passed the clause in the Bill of the London County Council enabling them to reconstruct and equip electrically the cable tramway at Highgate Hill.

On Tuesday the Select Committee finished the consideration of the Bill.

Mr. Erskine Pollock, K.C., for the Council, said that the L.C.C. had authority to construct tramways, under the Act of 1903, from Putney Bridge to Hammersmith Broadway, and from Harlesden to Hammersmith. It was agreed at that time that the Broadway

should be widened, and that the local authority should pay one-third of the estimated cost of £41,000, the L.C.C. to pay the remainder. There was no suggestion, however, that any time had been wasted, for cars were now running in the Broadway, and there was a considerable traffic. The Council now asked powers to run a temporary tramway across the Broadway, so that the public travelling from Putney to Fulham could get right through to the White City. There was, however, a convenience in the middle of Broadway, which would have to be removed.

Mr. Snowden, for the Hammersmith Borough Council, said they were absolutely convinced that whether the lavatory was removed or not, it would be dangerous to run tramways across the Broadway unless it was widened.

Evidence having been given on behalf of the Hammersmith B.C., the Committee allowed the clause giving the L.C.C. power to construct the line.

Oxford and District Tramways.—This Bill came before the Committee on Unopposed Bills on Thursday of last week, and formal evidence having been given in proof of the preamble, was ordered to proceed. The Bill provides for the substitution of the conduit and the overhead system in place of the Dolter surface-contact system of traction originally authorised in the Bill of 1907.

Sligo and Arigna Railway.—On Thursday, June 10th, the preamble of the above Bill, which authorises the Sligo and Arigna Railway Co. to construct about 4½ miles of railway in the Arigna Valley, was declared proved. A clause provides that electric power may be used for the railway.

L.G.B. INQUIRY AT WEST HAM.

On July 20th last year a Local Government Board inquiry was held at West Ham into the application by the Corporation to borrow the sum of £51,600 for the purposes of the electricity supply undertaking. At that inquiry, opposition was offered by Mr. Elvy Robb on behalf of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., who are large ratepayers in the borough, on the ground that certain large contracts entered into by the Corporation were unremunerative. After much information as to how the sum asked for was made up had been given, Mr. Seabrook, the borough electrical engineer, was requested to give certain information as to the power contracts, which he declined to do, and after some discussion the inquiry was adjourned *sine die*. Since then the Corporation has asked for sanction to a further loan of £23,000, and on the 15th inst. the adjourned inquiry for the application for the first loan, as well as that for the new one, was opened at Stratford Town Hall.

Mr. H. Ross Hooper, M.Inst.C.E., was again the inspector for the Local Government Board; Mr. Edward Morten, K.C., appeared for the Corporation; Mr. Elvy Robb, for the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; and Mr. Drucker, instructed by Mr. Tweedy Smith, on behalf of some wiring contractors in the borough who objected to the activity of the Corporation wiring department. The inspector grouped the applications together thus:—

First application	£51,600
Second „	23,000
	£74,600

Made up by:—

Excess expenditure on previous loans ...	£17,512
New plant	26,272
Suspense account	31,816
	£74,600

The suspense account included:—

Mains	£3,300
Transformers, &c.	18,516
House services	2,000
Motors	8,000
	£31,816

In the case of transformers and motors the application included the estimated requirements for the next three years, as well as sums for the placing of the cost of material, in stock but not in use, to capital account, and not to a suspense account as hitherto. A number of questions on items of expenditure left open from the last inquiry were answered by Mr. Seabrook, the borough electrical engineer, and Mr. Patterson, the borough treasurer.

It was stated that the total capital expenditure on the undertaking up to March 31st last was £438,558, and that the total loans sanctioned were £417,583. The general rate for the past year was 3s. 11d. and the poor rate 5s. 3d., making a total of 9s. 2d. A penny on the general rate produced £4,626. The plant at present installed consisted of 1,500 KW. direct-current and 9,900 KW. alternating-current plant, and the maximum loads last winter were 1,815 KW. for the direct-current and 4,328 KW. alternating-current, and a total maximum of 6,100 KW. The total units generated during the year ending March 31st last were 18,854,202, as against 13,340,940 units for the corresponding period of the previous year, an increase of 41 per cent., and the units sold were 15,522,085, as against 11,299,783 units, an increase of 37 per cent., the load factor rising from 23·5 per cent. in 1907-8 to 29·1 per cent. in 1908-9. The influence of the metallic-filament lamp was shown by a decrease in the units sold for private lighting from 2,123,336 units in 1907-8 to 1,928,528 units in 1908-9, a decrease of about 10 per cent. The number of motors on the mains increased from 445 (with a total horse-power of 6,224) on March 31st, 1908, to 833 (with a total of 8,683 H.P.) on March 31st, 1909.

The inquiry then turned to the question whether the contracts entered into by the Corporation for the sale of power were such as would prove remunerative. In reply to questions by the Inspector, Mr. Seabrook stated that the increase in the units sold during the past year had been mainly due to the power demand. The average price obtained for this part of the load had been 0·591d. per unit, and the lowest price charged to a consumer with an exceptionally good load factor was 0·37d.

The Inspector then pressed Mr. Seabrook for details as to whether this price was remunerative. Both Mr. Morten and Mr. Seabrook stated that it was, and that the proof of their assertion was to be found in the financial result of the past year's working, which showed an actual surplus of £3,853, or an improvement of £8,522 over the previous year's figures.

Mr. Robb further pressed Mr. Seabrook for full details as to how the sum of 0·37d. was made up, reminding him of a sentence in one of his reports to the Council, that each consumer should bear his own proportion of standing charges and running cost.

Both Mr. Morten and Mr. Seabrook persisted in declining to produce full details, either as to the proportion of standing charges included in the lowest charge of 0·37d., or as to the particulars of the cost on which their offer to supply was based. Mr. Seabrook, however, volunteered the information that the supply to the Silvertown district amounted to about 5,500,000 units, and the average charge for these units was 0·43d.

Mr. Drucker then asked for details as to the cost of working the wiring department. It was pointed out that the costs were not available at short notice in the form Mr. Drucker desired, but it was finally promised that an effort should be made to separate them and supply Mr. Drucker with the information he wanted.

The inquiry was then adjourned till the next day.

On the resumption of the inquiry on Wednesday, the Inspector pointed out that the very essence of the successful working of the electricity undertaking was the financial result, and that the only justification for the sanctioning of the large sum now asked for was the likelihood of the investment proving profitable to the ratepayers.

The promised statement as to the results of working of the Sales Department was then handed in, the borough treasurer explaining that in the short time available for its preparation he was only able to give approximate figures, and had not allocated a number of items which, in a regular trading statement, should have been included. He promised that such a statement should be prepared next year.

Mr. Drucker asked a number of questions both of the borough treasurer and of Mr. Holmes, the manager of the Sales Department, relative to the manner in which the department conducted its business, claiming that it undercut prices, and in reality was carried on at a loss at the expense of the ratepayers.

Mr. Robb opened the case for his clients, who, he said, were actuated by public-spirited motives, and who had gone to a great deal of expense in analysing the published accounts. They considered the figures at which the power contracts had been accepted were far too low for commercial success, and were prepared to call Mr. Stuart Russell, M.I.E.E., and Mr. W. H. Patchell, M.I.E.E., in support of their contention. At this stage the inquiry was adjourned till Monday, July 5th.

BUSINESS NOTES.

The L.G.B. and Workhouse Contracts.—The following memorandum has been issued by the Local Government Board to Boards of Poor Law Guardians throughout the country:—"In connection with the question of the contracts for the supply of goods to Poor Law Institutions, attention has been drawn to the fact that in some cases persons wishing to tender for the supply of commodities to such institutions have been unable to obtain, for the purposes of examination, patterns or samples of the goods required: that it seems desirable, in the interests of good administration and economy, that persons wishing to tender should have every facility for obtaining information as to the kind and quality of goods needed; and that such persons or their agents should be allowed to take away patterns or samples wherever this can be arranged. There would seem to be no difficulty in the adoption of this course in many cases—as, for instance, where the article required is clothing material or other woollen or cotton goods not made up; and in cases of articles, samples of which could not conveniently be given free of charge, it would probably be practicable in many cases to allow samples to be taken away if required on payment of a deposit."

For Sale.—On July 7th and 8th Messrs. Wheatley Kirk, Price & Co. will offer for sale by auction, under instructions from the receiver for the debenture-holders, a quantity of electric light fittings, &c., at 66, Berners Street, W. Particulars will be found among our advertisements to-day.

We are asked to let electrical contractors know that a clearance sale of the very large stock of electric light fittings is now being held at Fittings, Ltd., 112, Victoria Street, S.W. Everything has to be disposed of owing to the fact that the company are exchanging their premises and intend devoting themselves in future to a different class of business.

Book Notices.—*Eine neues Schnellbahnsystem.* By August Scherl. Berlin: From the author.—In this remarkable volume the author expounds his views on the organisation and construction of a system of high-speed railways. He commences by summarising the defects of the existing system—low speed, infrequent trains, faulty organisation, curvature, and other defects of track—and proceeds to describe a system which shall combine speed, safety, comfort, economy, and continuity of working. The speed at which he aims is 200 km. per hour. Each city is to be provided with a concentration system consisting of one or more circular railways, with radial lines like the spokes of a wheel, and is to be connected with adjoining cities by direct high-speed lines. The "radial-periphery system," as it is called, is carried over the tops of the houses in towns, the buildings being provided with internal columns to support the weight. The author rejects the two-rail track, and all the so-called monorail systems but that of Brennan—a true monorail, with gyrostatic balancing wheels. Each train is to constitute a complete and independent unit consisting of three coaches, with all modern conveniences, though the drawings show no provision for the accommodation of the propelling and balancing apparatus. There is only one class, apparently the first. The railway is never to be on the ground level; it is either elevated or underground, generally the former. The old idea of transferring passengers from a branch line to an express by means of a travelling carriage, running on a track close to and parallel with the main line at the same speed as the express train, is brought up again. The scheme is worked out in detail, even to the preparation of graphic schedules for the train service between Berlin and Hamburg, and the division of Germany and the adjoining countries into zones, and the lengthy description is illustrated with a wealth of sketches and drawings. The whole thing is very ambitious, very costly, and, we fear, hopelessly impracticable; but the author's enthusiasm goes far to excuse the Utopian character of his proposals.

"City and Guilds of London Institute." Report of the Council, 1909. London: The Institute.

Private Meeting.—Robert Dawson & Co., Ltd., Hartley Works, Stalybridge.—A meeting of the creditors in this matter was held last Wednesday, at the Chartered Accountants' Hall, Manchester. The statement of accounts presented showed liabilities £9,107, made up of the debentures £6,000, and interest £113, unsecured creditors' claims £2,986, and claim by bank £7 17s. The net assets are £4,013, and showing a deficiency of £5,094. It was reported that the company was incorporated in 1898. About three years ago it appears to have opened an electrical department, which had, it was stated, resulted in a loss of over £4,000, in addition to which a loss of £2,000 was said to have been incurred in connection with the heating apparatus business during the past two years. Some discussion took place at the meeting, and it was ultimately decided to confirm the appointment of Mr. J. B. Leach (Manchester), as liquidator.

Tinol.—Messrs. Neville, Williams & Co., 11 and 13, Southwark Street, S.E., have sent us a sample tin of Tinol and a neat little pocket blow-lamp. Tinol we have already described—it is a patented ointment-like paste, containing both solder and flux, and requiring only heat to enable a soldered joint to be made between metal parts. Tinol solder stick, which consists of a solder tube filled with Tinol, is another convenient form in which the stuff is made up. The pocket lamp is a novelty; by a slight modification of the ordinary type of spirit lamp, a neat little device is made, which gives a jet of flame about 4 in. long. It can be closed for carrying in the pocket without fear of spilling. We have tried all these things, which are described (and their uses explained) in a booklet issued by the company, and find them excellent. Messrs. Neville, Williams & Co. are sole manufacturers and agents for the United Kingdom.

Catalogues and Lists.—The London Electric Firm, George Street, Croydon.—New catalogue (No. 125) just issuing from the Press. The class of specialties that the firm manufactures is well known, but in this publication of 108 pages, the central station engineer, also the contractor and electrical trader, will find set out in full detail the "One Working Part" arc lamp lowering gear, with many and miscellaneous fittings, such as contact devices, small winches, guide pulleys, flexible wire rope, &c. A large number of pages are occupied chiefly with photographic views showing public thoroughfares and other places where this gear is in service, many of them representing complete change-over jobs that the firm have carried through. Copies of the catalogue, without the name of the makers printed thereon, can be obtained by any reader who, for business purposes, prefers them so.

The Electrical Co., Ltd, Charing Cross Road, W.C.—Two new sectional illustrated price lists, one giving full details of knife switches, the other covering a number of accessories such as lamp-holders, tumbler switches, cut-outs, wall-sockets and wall plugs, adaptors, &c.

Messrs. Kiblew Bros., Ltd., 198, Blackstock Road, N.—Leaflets relating to their iron cement, also the "K.B." emery grinder.

Perfecta Seamless Steel Tube & Conduit Co., Ltd., Plume Street, Birmingham.—New catalogue (No. 8) giving latest prices, also illustrations of a variety of the Perfecta conduits and fittings.

The Electro-Mechanical Manufacturing Co., Clun House, Surrey Street, W.C.—Fully illustrated list giving descriptive, dimensional, and other information concerning their improved portable electric drills with mechanical automatic overload release.

The Hudson Economiser Co. (1907), Ltd., 2, Bishopsgate Street Without, E.C.—New and finely got up catalogue (32 pages) of their economiser system of feed-water heating. Descriptions are given of their combined feed-water heater and oil separator, with notes of experiments and results, and particulars of the "Reliance" live steam feed-water heater (Hudson internal process). Testimonials and a lengthy list of users occupy several pages. A loose circular shows Brown's patent water cooler in course of erection at a Manchester brewery.

Messrs. Willans & Robinson, Ltd., Rugby.—Very finely produced catalogue of 56 pages, in which are contained many capital half-tone illustrations of the Willans-Parsons steam turbine. Full descriptive notes with diagrams of parts of turbines, also pictures of departments at the works and of machines in use thereat. Matter relating to the method of balancing the turbine and notes on bearings, governing lubrication, &c., is followed with tables of standard sizes, speeds and dimensions of turbo-alternators and direct-current turbo-dynamos. Exhaust steam turbines and condensing plants follow, with views of large turbine sets installed by the firm, the largest shown being a 6,000-kw. plant at Manchester.

Messrs. W. Geipel & Co., Vulcan Works, St. Thomas Street, S.E.—New 8-page illustrated list relating to Henrion carbons for open, enclosed and flame arc lamps. The Henrion works, for which Messrs. Geipel are sole representatives in the United Kingdom and the Colonies, are capable of turning out upwards of a million carbons per diem. Tabulated sizes and prices are given.

Messrs. Rose Bros., 30, Cheapside, E.C.—16-page illustrated catalogue of electrical novelties, including electric pocket lamps, torch, cycle and hand lamps, watch-stands, medical coils, induction coils, small metal and carbon-filament lamps. Prices are given.

Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, N.W.—Two leaflets, one particularising type 50 double-pole ironclad switch; the other describing type 28 wall pattern resistance.

Messrs. Marsh, Son & Co., Ltd., 15, Gerrard Street, W.—Two circulars describing and illustrating and giving prices of their new type automatic time switches (types Z and D D respectively) for shop window, sign, staircase, and other such lighting. Both switches will run a full eight days on one winding.

The British Thomson-Houston Co., Ltd., Rugby.—Advance copy of a well-compiled pamphlet containing full information, with good half-tone views, concerning the Curtis exhaust and mixed pressure turbines. Their compact design occupying small floor space, renders these turbines particularly suited for use in confined areas. They are manufactured entirely at the Rugby works, and we understand that a satisfactory number of orders has been received.

Hart Accumulator Co, Ltd., Marshgate Lane, Stratford, E.—This company has prepared a show card (roughly 21 in. × 16 in.) in the design of which a number of pictures of its storage batteries are artistically embodied. Copies of the card will be sent on receipt of trade card.

General Electric Co., Ltd., 71, Queen Victoria Street, E.C.—A batch of publicity literature is to hand. A four-page list illustrates Osram lamps with different shapes of bulbs, and very clearly indicates prices of same; a 24-page abridged pocket list gives details and prices of a variety of electrical accessories for motor-cars; a reprint from a magazine on "The Application of Electric Power in Shipyards," describes some of the company's manufactures for this class of service; and several loose cards relate respectively to, and give prices of, electric cooking outfits, "Peel" main switches; house service cut-outs; and ironclad distribution fuseboards.

Dissolutions and Liquidations.—Ellwood & Sledmere, Ltd.—This company is winding up voluntarily, with Mr. A. Neill, 118, City Road, E.C., as liquidator.

Electrical Works and Development Co., Ltd.—This company is winding up voluntarily, with Mr. R. A. Boughton, 52, Gracechurch Street, E.C., as liquidator. A meeting of creditors is to be held at his address on June 28th.

India-Rubber Estates, Ltd.—This company is winding up voluntarily, with Mr. H. S. Murphy as liquidator.

Messrs. S. J. Suter & Wood, electrical engineers, 2, Lower James Street, Golden Square, W.—Messrs. S. J. Suter & F. C. Wood have dissolved partnership. Mr. Wood will attend to debts, &c.

Measures Bros., Ltd.—On 9th inst. Mr. Justice Neville made an order for the appointment of a receiver.

The partnership of Robt. Sykes & Co., electrical engineers, 12, Dixon Street, Glasgow (Andrew Short and Robt. Sykes), has been dissolved, by mutual consent, by the retiral therefrom of Mr. Short. Mr. Sykes will carry on the business for his own behalf at the same address and under the same firm's name.

Aluminium Production in France.—The severe competition prevailing in the aluminium industry during the past year is reflected in the report of the Société Electro-Métallurgique Francaise, of Froges. The net profits, which amounted to £120,000 in 1907, receded to £28,120 in 1908, but by drawing upon the reserve fund to the extent of £12,480, it is possible to pay a dividend of £1 12s., or 8 per cent. on the fully paid shares, and 14s. per share on the partly paid shares. According to the directors' report for 1908, the expenditure on new installations reached £112,000, the greater portion of which related to the new plant at the Argentière works, which will be completed by the end of the year and th

production of aluminium begun. The original idea of reserving at these works 10,000 H.P. for the branch factory, La Nitrogène, which carries on the manufacture of nitrogenous products at Chèvres, seems to have been abandoned. The ordinary share capital is £600,000, of which nearly £280,000 is outstanding, whilst the reserve fund amounts to £488,000, including premiums of £424,000 derived from new issues of capital. The daily output of aluminium is 6 tons, and the stocks on hand comprise 1,600 tons. At the recent general meeting it was announced, on behalf of the directors, that the company will be able to dispose of the whole of the production and clear the stocks, as the use of aluminium is increasing. At present a moderate year's business is expected, but a more favourable period will presumably arise later on.

The Charge of False Pretences.—The case of William Parkinson, 27, electrician, which has already been referred to in these pages, came to an end at the Lancaster Assizes, when accused was found guilty and sentenced to 18 months' hard labour.

Municipal Contracting not Allowed at Devonport.—At Devonport Borough Council meeting on June 10th, the Education Committee in their minutes recorded a resolution "that the tender of Messrs. Corse & Co., electrical engineers, Plymouth, amounting to £238, for the installation of electric light in the higher elementary school be accepted, and the contract for the due performance of the work executed accordingly." Alderman Goodman was amazed at the decision, seeing that they had electric works and staff of their own. Mr. Brenton said there was a tendency in the committee to employ the Corporation works, but he thought that, contrary to the spirit of the age, seeing that their undertaking could charge practically what it pleased, open tendering was resorted to, and Mr. Corse secured it at a lower price than the Committee would have done it for. Mr. Bishop said he had always maintained that it was the duty of the Electricity Committee to supply current, and not to enter into competition with private contractors. Mr. May said the principle of tender was a good one, and Mr. Spark (electrical engineer) remarked that the Committee had made up their minds not to enter into competition with outside traders. The minute was carried unanimously.

Trade Announcements.—Mr. E. Goldston (late Lea & Warren), of 53, Gold Street, Northampton, has removed to more commodious premises at 28, Marefair. He invites manufacturers to send catalogues.

Owing to the increasing demand for their mining switchgear and specialities, and the rapid growth of their business, Engineering Instruments, Ltd., are removing their works to Darlington, where they have fitted up extensive and modern shops. Their new address, after the end of June, will be Skerne Works, Darlington, where all communications should be sent.

With reference to our recent announcement concerning the manufacture of water turbines by Messrs. Willans & Robinson, we learn that Mr. Jens Orten-Boving left for Canada last Saturday, on a prolonged business visit. While there he will be tendering for a large number of the great hydro-electric schemes that are now in hand. This, it is said, will constitute the first attempt that has been made by English firms to secure orders for large turbines in Canada, and when it is borne in mind that Canada finances the largest of the Mexican hydro-electric schemes, it will be seen what a great scope there is for the manufacture of water turbines.

Mr. H. G. Richardson, for some years manager of the manufacturing department of the Walsall Electrical Co., Ltd., has resigned his position with the company, and has commenced business on his own account as Herbert Richardson & Co., Shaw Street, Walsall, where he will do business in all classes of switchgear.

The new factory of Messrs. Arthur L. Gibson & Co., Radnor Works, Strawberry Vale, Twickenham, is now in running order, and in future all orders received for the Kinnear patent steel rolling shutters will be filled from that address. The firm's offices and warehouse will remain for the present at their old address, 19, 20 and 21, Tower Street, Upper Saint Martin's Lane, London, W.C.

The Sun Patent Evaporator.—The makers of this device write us as follows regarding the notice under this heading in our last issue:—"We beg to state that we think it rather a pity your reviewer did not take the trouble to inspect and investigate the working of our patent evaporator, since what he 'fails to see is possible,' unfortunately for his *ex cathedra* utterances, is a fact. We can show installations where, under conditions which admit of no doubt or uncertainty, the Sun patent evaporater is actually giving a higher economy in fuel, and a larger increase in steam evaporation than what we claim it will do. Moreover, it does reduce very markedly the time required to raise steam, and our clients are perfectly satisfied, after most careful expert tests and continued use, with the results obtained. However, it is not uncommon for the mere theorist to fail to appreciate what practice demonstrates is possible."

Of course, we did not expect the company to agree with our views! When duly authenticated tests by a recognised expert are forthcoming, we shall be pleased to congratulate the inventors.

Bankruptcy Proceedings.—Thomas Ward, of Totteridge Road, Enfield Wash, lately managing director of the Electrical Instrument Manufacturers, Ltd., Freesywater, Waltham Cross. At the Edmonton Bankruptcy Court on Monday, Mr. F. T. Garton, the Assistant Official Receiver, again asked that the public examination of the debtor should be adjourned *sine die*. Mr. Moeran, for the debtor, said that he had no objection to that, because his client would be willing to be further examined when his health permitted. But as soon as the Court granted such an application, the Assistant Official Receiver would ask to have the debtor adjudicated a bankrupt.

Mr. Garton: I intend to make that application.

Mr. Moeran reminded the Court that the debtor had been examined once, and then his health broke down necessitating adjournments of the case. He believed that the debtor was slightly better, but would not be able to undergo examination again for a few months. No doubt the Registrar had power to adjudicate him a bankrupt, but he (Mr. Moeran) asked that that should not be done. The estate was practically nothing, and he was told that a considerable part of the liabilities, which would amount to some £1,200, would really disappear, and that the actual debts to be satisfied would be £200, £300 or £400. The biggest debt, which was owing to his father-in-law, and amounted to £600, was statute barred.

The debtor had brought an action against a gentleman on a contract, and if he were successful in that he would have ample to pay all his proved debts in full. If he were made a bankrupt he could not proceed with the case, and the Official Receiver would not do so unless sufficient money was found to pay his costs and the costs of the other side, if he failed.

The Registrar asked if the Assistant Official Receiver were pressing for the order now.

Mr. Garton said he was. He contended that the Court ought not to refuse to make the order simply to enable the debtor to continue an action, knowing that he had no means of meeting the costs. If he were insolvent, the creditors were the people interested in the action, and if they were to derive a benefit from it they should undertake the responsibility for the costs.

Mr. Moeran, in answer to the Registrar, said that there was a winding-up motion in connection with the Electrical Instrument Manufacturers, but if the debtor succeeded in his action the company would be off the rocks, and there would be no need for it to be wound up. The action referred to dealings with the company. The pleadings were completed, and the case was ready to be set down for trial.

The Registrar, taking into consideration that there was no estate, did not consider that the creditors would be prejudiced if there were no adjudication, and declined to make such an order, but he adjourned the examination *sine die*.

H. J. Furniss, electrician, 5a, Queen Street, Derby.—A supplemental dividend of 6½d. in the £ is payable from June 16th, at the Official's Receiver's offices, Derby.

Re L. W. de Grave, 19, Queen Street, Derby, electrical engineer, metal worker, &c.—The public examination took place at Derby on June 14th. In addition to the facts already reported, it was elicited that the debtor had several times been sued. He said he had kept books of account, but they did not give a complete record of his receipts and expenditure, and he further admitted that they were in other respects incomplete. He had borrowed money from a professional money lender about a month before he filed his petition, and he had then stated that he only owed about £20. On that occasion he received £45 and gave a promissory note for £75. It was not until an execution had been put in by Messrs. Weston that he realised his position. The examination was closed.

Smoke Preventer.—We are informed that a new smoke preventer is about to be placed on the market by the Furnace Appliances Co., of 9, Bedford Row, W.C., who state that very complete and successful trials have been carried out during the past 12 months. They have also acquired the business of the British Fuel Economiser and Smoke Preventer, together with their works, offices, &c., and will commence operations on July 1st.

LIGHTING and POWER NOTES.

Acton.—The Electricity Committee considered the attitude of the Metropolitan Electric Supply Co., Ltd., in regard to the decision of the Council to accept its revised terms offered in November last, and at the same time to increase the prices of electricity for lighting purposes. The secretary to the company wrote that when these terms were made to the Council the company had no idea that the selling prices of energy were to be raised, and added that if the effect of the increases was to check consumption, the directors would probably consider themselves free to reopen the matter. The Committee decided to recommend that the company be asked to enter into an agreement with the Council embracing the terms of the letter sent last November.

Ashton-under-Lyne.—A L.G.B. inquiry was held on Friday relative to the application of the T.C. for a loan of £2,040 for extensions to the electricity works. There was no opposition.

Barnsley.—The T.C. has applied to the L.G.B. for a loan of £3,000 for electricity purposes.

Barnstaple.—The T.C. has decided to utilise electricity for heating the Albert Hall. The capital outlay for radiators, &c., will be £98.

Barton-upon-Irwell.—The R.D.C. has decided, subject to the approval of the B. of T., to transfer the E.L. order, so far as it relates to the parish of Clifton, to the Lancs. Electric Power Co., who will pay the Council £433 in respect of the charges of obtaining and transferring the order. The Council is to have the option of purchasing the undertaking at the end of seven years, or at the expiration of any subsequent seventh year.

Basingstoke.—The electrical engineer's recommendation to install a further 300 public electric lamps in various parts of the town where the mains are laid, is to be considered at the next meeting of the sub-Committee. Meanwhile the engineer has been authorised to continue with the installation up to 430 lamps.

Bath.—An experiment with metal-filament lamps for street lighting is in progress. It is proposed to allow the town clerk an honorarium of 150 guineas for extra work involved in connection with the recent company scheme, the amount to be deducted from the deposit of £2,500 forfeited by Mr. Schenk.

Brighton.—The T.C. has decided to extend the mains so as to supply power for driving the bakery and laundry machinery at the workhouse. The Guardians will pay £15 per annum for five years to defray the cost of the mains, which will then become the property of the Guardians.

Burslem.—At the T.C. meeting on Monday, a discussion took place with regard to the question of extensions at the electricity works, the electrical engineer, Mr. Ashton Bremner, having submitted an estimate of additional plant, which he stated it was necessary to put down in order to be prepared next winter in case of a breakdown in the existing plant, amounting to £7,535. The General Purposes Committee had recommended that the proposed extensions be approved of, and that application be made to the L.G.B. for sanction to borrow, and the recommendation was adopted.

Bury St. Edmunds.—At a meeting of the T.C. on Tuesday, the electrical engineer (Mr. S. G. Day) submitted his annual report. Mr. Day stated that the demand for energy for power purposes was increasing. Improvements in public lighting had been carried out during the year, metallic-filament lamps of 56 c.p. having replaced old 16-c.p. carbon lamps with satisfactory results. When the use of these lamps had become more general, Mr. Day considered that a substantial saving in current for public lighting purposes might be anticipated.

Camberley.—At a meeting of the U.D.C. E.L. Committee, a letter was read from the Secretary to the Army Council, stating that there was no immediate prospect of a change being made in the method of lighting the colleges and camps, and that under the circumstances, the department was not prepared to enter into any arrangement for taking current from the Council, should the latter proceed with its electric lighting scheme. In view of the attitude of the War Office, the Committee decided that it was not prepared to make any recommendation to the Council in favour of the establishment of an electric light undertaking, but would leave the matter to the Council for decision. The chairman of the Committee (Dr. Rayner) said the Committee felt that without the support of the Army Council the scheme would not commend itself to the Council as being sufficient in itself to warrant their taking up a prov. order, but he proposed putting a notice on the agenda asking the Council to reconsider the matter, because he felt that the district as it was would warrant their taking up an order, and that if they did not do so now, they would regret it in the future.

Cleckheaton.—A L.G.B. inquiry was held on June 10th, relative to the application of the U.D.C. for a loan of £2,681 for electric lighting purposes. There was no opposition.

Continental Notes. — Germany. — The municipal authorities of Langburkersdorf, Saxony, have decided on the establishment of a central electric lighting station in the town.

Belgium.—La Société des Tramways Vervietois, of Verviers, has secured a concession for the supply of electrical energy for private purposes in the town for a period of seven years.

Cullompton.—The promoters of an electric lighting scheme for the parish have applied to Devon C.C. for consent to their application for a prov. order.

Devonport.—The annual report of the Corporation electricity works for the year ending March 31st, 1909, states that the total units generated were 2,140,047, against 2,111,390 in 1908; 487,669 units, or 22·8 per cent., were sold to private consumers, against 453,318, or 21·5 per cent., last year; 26,722, or 1·3 per cent., for street lighting, against the same quantity in 1909; 1,178,815, or 55 per cent., for traction purposes, against 1,193,447, or 56·5 per cent.; motors, 29,276, or 1·4 per cent., against 21,802, or 1 per cent., making a total sold of 1,722,482, or 80·5 per cent. The units unaccounted for were 261,585, or 12·2 per cent., against 266,189, or 12·6 per cent., last year. The number of 8-c.p. lamps is 32,482, or an average per consumer of 81·32, against 28,519, with an average of 81·25 in 1908. The average price obtained is 2·295d., against 2·277d. The total income from energy sold was £16,469, an increase of £388, or 2·4 per cent. In 1908 the income was £16,081, a decrease on the previous year of £332, or 5·5 per cent. The gross profit in 1909 was £7,294, or £6 05 per cent. on a capital expenditure of £120,502; in 1908 the gross profit was £6,790, or £5 67 per cent. on a capital expenditure of £119,700. The net profit, after providing for sinking fund and interest, was £79, against £3 14s. in 1908.

Dundee.—The accounts of the Electricity Department which have just been closed show very steady increase in the sale of energy, in spite of the almost universal use of the metallic-filament lamp, while there is also a slight decrease in the working expenses. The total revenue received amounted to £36,975, an increase of £2,000, and after deduction of expenses, interest and sinking fund, there is a balance of £1,256 to be carried to next year's account. Included in the costs this year is the sum of £7,500, which has been transferred from the capital account and paid out of revenue, reducing the capital debt by this amount. It may be mentioned that the department has during the past four years paid £31,500 out of revenue for this purpose. It is expected that the new system will be put in operation very soon now, practically all the plant having been erected.

Mr. Harry Richardson, the Corporation electrical engineer, reported to a meeting of the Electric Lighting Committee that requests for motors for power had been becoming more common, and he asked that a small sub-committee be appointed to go into the matter with him. It was pointed out that when last the subject came up the Council received representations from electrical firms in the city, and decided not to go on with the scheme. A sub-committee was appointed, and the town clerk is to report as to the powers of the Corporation to hire out motors.

Ealing.—The charge for energy for outside arc lamps is to be reduced from July 1st to 3½d. per unit, subject to the consumer paying the rent of an extra meter.

Golborne.—The B. of T. has informed the U.D.C. that the consideration of the revocation of the E.L. Order has been deferred for a year from May 17th.

Hastings.—When the general district rate estimate was adopted in March, provision was made for an anticipated heavy deficiency in the electric lighting balance-sheet. The accounts for the year ended March 31st show how amply the anticipations were justified. The total expenditure was £9,514, as compared with £9,790 in the previous year; the gross profit was £7,334, as compared with £8,043; sinking fund and interest, &c., required £11,135, as compared with £11,025. The deficiency on the year's working is £3 801, and last year's deficiency was £2,982, making a total deficiency of £6,783 in two years. The balance of debt stands at £165,163. The sale of energy last year brought in £15,976, including £3,088 for public lighting. Recently, in view of the financial position, the charge for energy has been raised, and the Council is endeavouring to help matters by extending the street lighting by the transference of gas lamps. At present there are 113 public electric lamps in the streets, and an additional 100 are to be added immediately, the expense of transference to be met out of current rate. Some months ago the local gas company successfully opposed an application for a loan which would have enabled the Corporation to use electricity in 700 additional public lamps, instead of purchasing from the gas company.

Hemel Hempstead.—The Chesham Electric Light and Power Co., Ltd., has again decided to apply for a prov. order and, subject to the terms and conditions arranged when a previous application was made and withdrawn owing to an informality in the notices, the T.C. has decided to support the application.

Heywood.—The electrical engineer has reported to the Electricity Committee that the matters arising out of the contract for the supply of a balancer-booster set have been submitted to arbitration in accordance with the contract.

Hornsey.—The installation of the electric light in the boys', girls' and infants' departments, and the cookery centre of the North Harringay school, is to be completed.

Iceland.—A Norwegian syndicate proposes to put down a plant to utilise certain available water power at Skjalfandafljot for the generation of electrical energy for lighting and power purposes.

Ilkeston.—The manager of the tramways and electricity department, Mr. Gilbert, has reported upon extensions of mains in five miles of streets. The cost would be £5,000, and as several applications for supply have been received, powers to borrow this money are sought by the Committee.

Kearsley.—At a meeting of the D.C. held on June 10th, it was decided to urge the Board of Trade to push on with their consideration of the draft transfer of the Council's electric lighting order.

King's Lynn.—The Electricity Committee of the T.C. reports that after providing for working expenses, interest and sinking fund, a profit remained for 1908-9 of £443, as compared with £564 in 1907-8. The price of energy was reduced to ordinary consumers during the second half of 1908-9 from 5d. to 4½d. per unit. The total number of units sold was 523,563, producing £5,817, as compared with £6,235 in 1907-8. The receipts from all sources in 1908-9 were £6,607, as compared with £6,978, and the total expenditure was £6,164, as compared with £6,415. The average works cost for the past year was 1·215d. per unit, as compared with 1·247d. per unit in 1907-8.

Leyton.—The U.D.C. has applied for a loan of £2,468 for mechanical stokers at the electricity works.

Little Hulton.—In sanctioning the transfer of the Council's E.L. order to the Lancs. Electric Power Co., the B. of T. has inserted 10 years as a period when the undertaking may be transferred back again, in addition to the agreed terms of seven, 14 and 21 years. The Power Co., however, objects to the addition.

London.—Bermondsey.—The Electricity Committee reports that Messrs. Jennings & Co., of Bristol, whose tender was accepted for the supply of meter boards, do not see their way to post on their premises the usual notices relating to Trade Union rates of wages, but they are prepared to give an undertaking to pay

fair wages to the men employed on the work, and to hand to the men engaged on such work a copy of the notice. The rate of wages paid would be 6d. per hour to the men who work on the goods, except the machinist on spindle, who would get 9d. per hour, and the number of working hours per week would be 54. The Committee considers these rates fair, and has given instructions for the work to be proceeded with. Special terms are to be arranged to supply current to Messrs. Burt, Boulton & Haywood at their premises at Rotherbithe Street and Messrs. Taylor, Plimston & Co., at their premises, 94, Bermondsey Wall.

PADDINGTON.—The General Purposes Committee reports that its negotiations with the Metropolitan Electric Supply Co., to reduce the price charged for energy in the borough, had no result. The company say that a recent revision in their charges, together with the gradually increased efficiency of the metallic-filament lamps, have had considerable effect on their revenue, and make it impossible for them to lower their rates further.

ST. PANCRAS.—The Electricity Committee has had under consideration the question of obtaining motors for the purpose of lending them to prospective consumers as a means of providing them with an opportunity of ascertaining the actual cost of electrically driving their machinery, as compared with the cost of their present plant. A number of firms have been asked whether they would be prepared to lend motors to the department for this purpose, and Messrs. Bruce Peebles & Co., Ltd., and Messrs. Cutting Bros., Ltd., have agreed to do so.

FULHAM.—On a report from the borough electrical engineer, it is proposed to alter the lighting of the Munster Road depôt, by putting in transformers and metal-filament lamps at a cost of £35. The candle-power will be doubled, and the current consumption halved.

STEPNEY.—The President of the Board of Trade has written to the local Member in regard to an endeavour to obtain the inclusion in the Electric Lighting Acts (Amendment) Bill, 1909, of a provision excluding Sec. 81 of the schedule of the Electric Lighting (Clauses) Act, 1899, which runs as follows: "Nothing in the said order shall exonerate the undertakers from any indict, action or other proceedings for nuisance in the event of any nuisance being caused or permitted by them." Mr. Churchill writes: "The provision referred to was excluded from the Bill as introduced this year, in view of the strong attitude now adopted by the Office of Works, Admiralty and the authorities of Parliament, in regard to the exemption of generating stations from liability for nuisance. The feeling shown on this question is indicated by the new Clause 2 (requiring Board of Trade consent to the construction of generating stations on sites acquired by agreement), which was inserted by Committee of the House of Lords. The omission of the provision referred to does not necessarily mean that Sec. 81 of the Clauses Act will apply in all cases, but it leaves the application or non-application of it open for consideration in the case of each provisional order applied for, and the Board of Trade will consider each case on its merits, after hearing objections which may be made to the premises being exempted from action for nuisance."

Luton.—The T.C. has decided to extend the mains so as to supply current to the Luton Iron Foundry Co., Ltd., York Street, High Town.

Maidenhead.—The T.C. has applied to the L.G.B. for an addition of £400 to the loan of £3,500 asked for, so as to increase the capacity of the proposed new plant from 100 KW. to 150 KW.

Manchester.—A breakdown in the Manchester Corporation electrical system shortly after 2 o'clock on Monday morning resulted in a serious explosion at the Victoria Arcade, St. Mary's Gate, and caused considerable inconvenience to several of the newspaper offices in the city. The explosion, though causing much damage to property, resulted, fortunately, in no injury to person. The explosion shook the whole of the Victoria Buildings, which cover an extensive area. Windows were wrecked by hundreds, offices dismantled, and wreckage blown across the street and hrough shop windows some 50 yards distant. Blocks of concrete from the pavement of the Arcade were hurled in every direction. n an official explanation issued by the electricity department, it is pointed out that the fault which gave rise to the disaster occurred on the surface wires laid into the Arcade at the point where they are jointed on to the distributing cables laid along St. Mary's Gate under the footpath, and that defective jointing was the primary cause of the explosion. "This," the report continues, "is a very old service, having been laid in 1896, and the method of attaching the service cables to the distributing mains is not the one adopted to-day. It should be pointed out in order to allay any fears on the part of the public that the department is rapidly changing over these old service cables and jointing them up to the distributing mains in more up-to-date and safer fashion. The fusion of the electric cables due to the defective joint melted the bitumen in the surrounding troughs, and the liberation of the bitumen and gas would account for the force of the explosion. It was an unfortunate coincidence, that alongside the electrical service mains were four large gas services, and these were fused by the electric arcing that took place. This, doubtless, contributed in no small degree to the extent of the damage which has been done."

Navan (Ireland).—At the last meeting of the Board of Guardians, it was resolved to light the Workhouse buildings with electricity.

Neston (Cheshire).—A letter from Mr. Robinson, electrical engineer to the Hinterton Electric Supply Co., applying for leave to carry a pair of overhead electric light cables across Hinterton Road, was considered by the Neston (Cheshire) U.D.C. on Monday, when the clerk was instructed to inform the company that sanction for overhead cables could not be given.

New Malden.—The Council at its last meeting considered terms offered by Wimbledon Corporation for a supply of electricity in bulk, and resolved, in accordance with the suggestion made by the last-mentioned authority, to ask it to give to New Malden *pro forma* notice of intention to apply to the Board of Trade for a prov. order applicable to the district. It was stated that it was possible for a supply to be obtained from Wimbledon by January next.

Northampton.—Owing to the increasing demand for electricity, both for light and power, the Northampton Electric Light and Power Co., Ltd., are about to extend their works. Plans have been passed by the Town Council, and the work has been put in hand. A new boiler is to be fitted, and an economiser with an overhead coal bunker and a new chimney and water-cooling tower, are to be built. The additions to the generating machinery will include a 1,000-H.P. engine and dynamo.

Plymouth.—The Electricity Committee is considering an application from the Rinkeries Co., Ltd., for a supply of electricity for a proposed rink. The question of the system of electric lighting which should be adopted at the new museum and art gallery is to be brought up at the July meeting of the Museum and Art Gallery Committee.

Rugby.—The committee appointed by the U.D.C. to consider a scheme for the conversion of the present system of public lighting by gas to electricity, and the provision of a central generating station, reported at Tuesday's meeting that inasmuch as the Council was under a contract with the British Thomson-Houston Co. for taking a supply of electric current until October 28th, 1913, they were unable to recommend the Council to establish a central generating station. Also that, taking into consideration the uncertainty of the future of the metallic-filament lamps, with respect to the public lighting of the streets and the possible improvements that might take place, the committee were of opinion that it would be unwise for the Council at present to incur the capital expenditure the proposed change would entail; but that in any future contract entered into by the Council for public lighting, power should be reserved to the Council to light, at its discretion, a limited number of lamps by electricity in order that experiments might be made.

St. Annes-on-Sea.—The U.D.C. has reduced the price of current for motor, heating, and cooking purposes to 2½d. per unit for the first 100 units, 2d. per unit for the second 100, and 1½d. per unit beyond.

Salford.—Mr. A. W. Brightmore, D.Sc., M.I.C.E., held a L.G.B. inquiry on the 15th inst. into the application of the Corporation for permission to borrow £2,200 for the purposes of the electricity undertaking. It was stated that it was intended to sink a shaft at the Frederick Road Station to enable the department to obtain a water supply of their own, the supply previously having been obtained from an adjoining canal. For the latter supply the Corporation had had to pay £1,000 per annum, and the agreement had now terminated.

The Electricity Committee has approved of the action of the chairman (Councillor Billington) and the deputy-chairman (Councillor Wheatcroft) in protesting against an increase from £4,000 to £6,500 in the committee's estimated contribution out of profits towards the relief of the rates for the current year.

South Crosland.—The U.D.C. has asked Huddersfield T.C. to extend its electricity mains to its district. Huddersfield offers to supply current at 10 per cent. more than is charged within the borough.

Southampton.—At a meeting of the Council held on Wednesday last week, the Highways and Lighting Committee presented a report recommending that 430 gas lamp standards should be replaced with electric (metal) lamps. The improved lighting on some of the standards which have been already changed over has met with general appreciation by the public, the amount of light being largely increased at a somewhat lower cost than with the old efficient gas mantles.

Stafford.—The annual report of the electricity department of the Corporation shows that the revenue from the works last year was £4 466, and the expenditure £2,001, the gross profit being £2,465, compared with £2,587 in the previous year. That amount was transferred to the profit and loss account. A sum of £66 14s. was allocated for the payment of bonuses to the men employed in the electricity department.

Sunderland.—At a meeting of the T.C., on the 9th inst., Alderman W. Bruce, in moving the adoption of the Electricity Committee's report, stated that the present was the first year they had had to report a decrease in the output of the undertaking. If the concern had been owned by a private company, however, a dividend of 5 per cent. could have been declared and £5,000 carried to reserve. The sinking fund was going on year by year at compound interest, and in 15 years the plant installed at Doxfords and Laings would have been paid for. There were indications that shipbuilding was beginning to revive, and he hoped they would in the near future show a credit balance. The report was adopted.

Sutton (Surrey).—At the meeting of the Metropolitan Asylums Board, on Saturday, the Works Committee reported having had before them a letter, dated May 21st, from the Fulham Guardians, in which they state that they have found the "lighting of the Belmont Workhouse by gas is very expensive, and consider it would be more economical to have the building wired for electric light," and asking the managers to grant them a sum to enable this to be done. The Committee having given due consideration to the Guardians' representations, recommended that they be informed that the managers do not feel justified in incurring any further expenditure in connection with the buildings.

Taunton.—At a meeting of the T.C. on Tuesday last week the Electricity Committee recommended that the present complicated system of charging for the light by demand indicators be abandoned, and that the following scale be adopted instead:—Consumption of under 25 units per quarter, 6d per unit; over 25 and under 500, 4½d. per unit; over 500 and under 1,000, 4d. per unit; over 1,000, 3d. per unit, and for arc lamps outside business premises 2d. per unit. The report was adopted.

Uxbridge.—At the last meeting of the Board of Guardians it was resolved, in view of the unsatisfactory electric lighting in the new buildings, that the Uxbridge Electric Lighting Co. be approached to report as to suggestions for rearrangement of the lighting and improvements required, and estimates of cost.

Warrington.—A financial statement regarding the electricity undertaking shows that the gross profit for 1908 stood at £6,739, as against £7,533, the net profit being £942 as compared with £2,213 in 1907. The income from sale of current had decreased by £1,153, and there was a diminution of £382 in working expenses.

Watford.—The U.D.C. has received from the L.G.B. sanction to a loan of £4,952 for electric light purposes.

Wednesbury.—In the annual report of the working of the Corporation electricity undertaking, it is stated that the year has been one of transition from the old scheme of buying in bulk to that of separate generation. The change-over from the two-wire to the three-wire system was made in September. The old battery has been entirely replaced by Tudor cells under the Tudor Co.'s maintenance contract. The income has amounted to £2,086, including £2,012 from the sale of electricity, and the expenditure to £1,648, of which £1,133 was generating expenses. The profit on the past year's trading was £438, and the balance brought forward from last year made the total balance £634, which has been allocated as follows:—To extinguish accumulator suspense, £61; to write off new change-over scheme, £226; motor change-over and special, £22; free wiring, £30; bank charges on capital overdraft, £111; and balance to carry forward to next year, £184. All the change-over expenses so far incurred, and the old accumulator suspense accounts, are wiped off. The increased profits due to the economies which have been effected will be sufficient to pay £718, the amount of interest and repayment charges falling due this year in respect of the new loans raised to carry out the changes in the system of generation.

Whitehaven.—At a meeting of the T.C. on June 9th it was reported that the Whitehaven Colliery Co. had decided to provide their own electricity plant for the Wellington Pit, the terms of the Council for the supply of current not having been accepted.

Whitwood (Yorks.).—The B. of T. has extended the E.L. order of the U.D.C. for a year. The Council is negotiating for the transfer of the order to the Yorkshire Electric Power Co.

Wolverhampton.—The electric mains are to be extended in Lea Road from Penn Road to Copthorne Road, at an estimated cost (including street lighting) of £1,400, and in Clifton Street, Allen Road, and Avondale Road, at an estimated cost (also including street lighting) of £153. It is also proposed to provide coal-conveying plant and mechanical stokers, &c., at the generating station, at an estimated cost of £870, by which a considerable saving will be effected.

Worsley.—At a meeting of the D.C. held on June 14th, it was decided to transfer the E.L. order to the Lancashire Electric Power Co.

Yarmouth.—At the meeting of the T.C. on Tuesday Councillor Johnson, reporting on the financial statement of the electric light undertaking, stated that although 7,600 lamps for private consumers had been installed during the year, the returns from private lighting only showed an increase of £4. The Committee made a gross profit of £7,597.

TRAMWAY and RAILWAY NOTES.

Accrington.—At the T.C. meeting last week Alderman Higham, chairman of the Electric Tramways Committee, expressed regret that the credit balance for last year was only £793, or about the third of a penny per car-mile. Referring to the result of the electricity department, he said the net revenue was £2,549, which compared very favourably with the net revenue of £604 for the previous year. The disposable balance was £866. He hoped the results would improve as the years went by.

Acton.—It was reported at this week's meeting of the U.D.C. that the London United Electric Tramways, Ltd., had made application for an increase of the maximum speeds on certain portions of the line of route, and that Lieut.-Col. Yorke, R.E., had been appointed to make an inspection and report. The company desired to increase the speed of the cars to 16 miles an hour. The present maximum is 10, except in the busiest part of the town, where it is 8 miles. The clerk pointed out that the company had now laid a double line of metals through the greater part of Acton. It was resolved that opposition be directed to any increase of speed between Gunnersbury Lane and Birkbeck Road, which mainly comprises the business thoroughfare.

Atherton.—Through running between Atherton, Tyldesley, Mosley Common, Worsley, Swinton, Walkden and Farnworth, was commenced on Monday on the South Lancashire Tramway Co.'s system.

Brierfield.—The Burnley Corporation electric cars run through the urban district of Brierfield and the Borough of Nelson, and the time is approaching for the renewal of the agreements. Correspondence has passed between the clerk of the Brierfield Council and the Burnley Corporation, and the result is that the Nelson Corporation is to be asked to meet a deputation of the Brierfield Council, in order to ascertain what are the final terms as to the price of electricity which the Nelson Corporation is prepared to assent to, the natural outcome of which may be to secure to the Brierfield Council an increased rental of the tramway within its district. The Brierfield Council considers itself perfectly unfettered to deal with Burnley both as to the price of electricity supplied and as to the rental for the working of the tramways.

Continental Notes.—GERMANY.—A period of four years has been required in order to clear away all the preliminary difficulties which have arisen in connection with the scheme formulated by the Berlin Municipal Council for the construction of an underground electric railway to connect the northern and southern districts of the city. The final step in the direction of placing the project in the way of realisation is represented by the sanction which has recently been given by the Kaiser, who, as King of Prussia, has the exclusive right of determining, on the basis of the Secondary Railway Act, schemes of this kind in the police district of Berlin. The North-South Railway, which was resolved upon by the municipal authorities in the autumn of 1905, will be carried through the Friedrich-Strasse, and will have a total length of nearly 5 miles. It is estimated that the cost of construction, including the acquisition of certain sites, will amount to £3,000,000, and the work will require four years to complete. The scheme provides for the erection of 14 stations, an average speed of about 17 miles an hour, and the whole journey to be accomplished in 18 minutes. The negotiations with the neighbouring districts of Wilmersdorf, Schoneberg and Rixdorf, which originally desired an extension of the railway in their respective districts, have not yet been concluded, whilst a prolongation of the line to Reinickendorf as a surface railway seems to be assured. It is intended to build the railway as a shallow underground line, and the work will be commenced as soon as possible, having regard to the threatened competition of the western suburbs.

AUSTRIA.—Plans are under consideration for an underground electric railway in Vienna for the transmission of postal matter; it is proposed to link together the chief post office and 64 sub-stations, and the nine railway stations in the city. An electrical firm has undertaken to build and equip the line entirely, and to lease it to the city and postal authorities.—*Pall Mall Gazette.*

RUSSIA.—A general strike of electric tramway men is in progress in St. Petersburg, the questions of wages and shifts being the grievances.

Croydon.—The accounts of the B.C. tramways for the year ended March 31st, with the report of the general manager (Mr. T. B. Goodyer), were presented on Monday. The total revenue for the year was £73,616 and the working expenses £54,726. After allowing for interest and sinking fund, there was a net available balance of £3,294, which the Committee recommended should go to the reserve for renewals, which at March 31st stood at £18,282. The professional auditors reported that the balance did not appear to them to be an adequate contribution in respect of renewals of track and rolling stock which might be anticipated, which inadequacy they had pointed out on former occasions. The manager attributed the lack of a larger balance to (*a*) general depression in trade; (*b*) motor-bus competition, which had reduced the average receipts on the main route by 1·44d. per care-mile; and (*c*) unfavourable weather between July and September. The passenger receipts were £72,053, a decrease of £157, but, being Leap Year, there was one day less. On the three sections unaffected by motor-bus competition there were increases of ·12d., ·14d. and 35d. per car-mile. For current £18,237 was paid to the electricity department. The consumption of 1·25 units per car-mile compares favourably with the average of 1·46 on 69 other systems. Ald. Trumble, moving the recommendation, contended that, on the whole, the reports were satisfactory, considering that the track was in good repair and the rolling stock in splendid condition. He anticipated a great improvement when the L.C.C. system was linked up with theirs at Norbury. In the course of a vigorous discussion, the financial position of the undertaking was strongly criticised. The recommendation was carried. The Council authorised a new arrangement by which tram tickets combining admission to the Crystal Palace should be issued on the Norwood route.

Glasgow.—At the last meeting of the T.C. ex-treasurer Alex. Murray protested against the withdrawal of the "Kilmarnock clause" from the Corporation Bill now before Parliament. He thought the T.C. Committee should have shown a little more friendliness to the railway companies in this matter. These companies had undoubtedly been hit severely with regard to the suburban traffic by the tramways, and was it reasonable to ask the companies—who were the largest ratepayers in the city—to help the Corporation to borrow under the Loans Act in order to help to run the cars better in competition with the railway companies? Councillor W. F. Anderson pointed out that in the tramways undertaking the Corporation had a property worth £3,000,000 and yet was not allowed to do with the surplus what it liked. No action was taken.

Halesowen.—At a meeting of the U.D.C. last week, the Light Railways Committee reported that a deputation from the Council had met in conference with representatives of the County Council and the promoters of the light railways transfer order, and it was eventually decided that the promoters should give the U.D.C. four months' notice of their intention to commence the construction of the railway, the County Council to contribute £100 to the cost of the acquisition of the land, and the promoters to pay to the County Council £1,500 on commencing the construction. The Council approved of this agreement.

Ilford.—At the last meeting of the U.D.C., it was reported by a joint committee of the Electricity and Lighting and Tramways departments that it had carefully considered the charge to be made by the electricity department to the tramways for energy supplied for traction purposes during the year ended March 31st last, and recommended that such charge be fixed at 1½d. per unit. Councillor Stroud, chairman of the Tramways Committee, now opposed the recommendation, and moved an amendment that the charge be altered to 1d. He said the tramways were the salvation of the electricity undertaking, being its best customer. It was understood that the undertaking should have its energy at works cost, which was about ¾d. per unit. The Council allowed some private consumers to have the current at 1d., and the tramways department should have it as cheaply. Councillor Everett seconded, saying he could not see that the electricity department should make £780 profit out of the tramways, but for which the former would be bankrupt. Councillor Philpot, chairman of the Electricity Committee, pointed out that the works cost was '89d., but the total cost, with capital charges, was 1 17d. It was true they supplied some private customers at 1d., but the tramways had to be supplied off a separate machine. It was a recognised thing in the electrical and tramway world that the tramways paid a trifle more than the ordinary consumer. East Ham tramways paid 1½d. per unit, and if Ilford charged that they would have a profit of over £1,000 on the electricity department. West Ham only charged 1d., but they were a very big concern, and had many private customers who were charged below 1d. Councillor Brand supported the amendment. He said it was only right that the Electricity Committee should have a fair amount of profit, but he objected to the fact that a private consumer taking 80,000 units per annum was only charged 1d., while the tramways, consuming nearly a million units, were charged 1½d. He ridiculed the idea that the use of a separate machine had anything to do with the charges. In the result, the amendment was lost, only four members voting for it, and the recommendation of the joint committee was adopted.

Merton.—The Council is sending a representation to the Board of Trade regarding the nuisance caused by the noise of the tramcars.

North-East Coast Railways.—It would appear, writes the Newcastle correspondent of the *Yorkshire Daily Post*, as though the long-talked-of extension of the North-Eastern Railway electrified suburban system is likely soon to become a fact. Plans have been in hand for some time for a Newcastle to South Shields, South Shields to Sunderland, and Sunderland to Newcastle service, and the company's officials have now concluded a census which has been going on for some time. From this will be learnt not only how many passengers are carried and when most are carried, but also the amount of passengers' luggage, parcels, &c., to be dealt with. Building requirements for rolling stock will be gauged from the census, and the work will probably be put in hand within a few months. An earlier start might have been made after the completion of the King Edward Bridge, but work was delayed to observe the London, Brighton and South Coast Co.'s system of electric traction. It is understood the North-Eastern Railway will continue with the continuous-current system, as on the Tynemouth line. The change of system will mean making Sunderland a terminus for Hartlepool, Middlesbrough and Stockton trains, but through Liverpool and Leeds expresses will probably continue to run to Newcastle, and steam trains on the Leamside branch will also run in over the electrified system from Pelaw.

Sheffield.—An unusual accident occurred on Saturday last. A private motor-car was being driven down the steep incline from the toll-bar towards Firth Park at a fairly good pace. When nearing Norwood Road, a point about midway down the hill, two cars were standing at the tramway station there blocking the centre of the road. The driver of the motor made an atttmpt to pass on one side of them, but the car leaped on to the causeway, and crashing into an electric section box (one of the heavy square boxes placed at intervals along the tramway routes), cut it clean away at the ground, and severed the service cables which convey the current from the power station. All that was inflammable about the section box took fire, says the *Sheffield Daily Independent*. The section between Pitsmoor and Firth Park being dead, the service of tramcars on that route was badly disorganised, but the tramway authorities did not lose any time in meeting the difficulty. The various sections of the city tramways are fed with current from the power station by independent cables, and so it was possible to make a circuit and bring the current overhead from Brightside to Pitsmoor. When working order was restored practically a new service commenced, seven cars having to be withdrawn from the route owing to the current not being sufficient to work the full service.

Taunton.—The T.C., after a discussion regarding the state of the tramway track, instructed the borough surveyor to prepare a specification of the works necessary to make it safe and satisfactory. Notice will be given to the tramway company to carry out the work.

Twickenham.—Recently Sir Clifton Robinson wrote to the Council to the effect that it was the only authority which complained of the noise of the tramcars. Various local authorities have now replied to a letter from the clerk asking if they had made complaints. Chiswick Council replied that no particular complaint as to new cars had been made recently. Hampton Council stated that it had repeatedly complained of the excessive noise of the cars, but no complaints had been made since August of last year, because the complaints in the past had been treated in a cavalier manner by the company. Teddington Council wrote that it had addressed several letters to the Chief Commissioner of Police, asking him not to license the noisy cars. Hampton Wick Council stated that it had written for the past two years to the Commissioner of Police and not to the company, as it found it was useless writing to the latter.

Yarmouth.—At a meeting of the T.C. last week, the chairman of the Tramway Committee reported that the accounts for the past year showed a total revenue of £23,693, which was £784 less than last year. The expenditure had totalled £16,908, an increase of £558, caused largely by the automatic increase in salaries, and repairs to the rolling stock. They paid £800 in rates, and £6,784 as interest and sinking fund, carrying forward £299. The Electricity Committee charged them 1¾d. a unit, and he was satisfied that they were paying £700 a year in this respect more than they should do. Since the undertaking was started, they had paid into the sinking fund, with interest, £10,817; to the renewals fund, £4,206; and their own insurance fund, £931.

TELEGRAPH and TELEPHONE NOTES.

New Microphone.—The Berlin-Stockholm trials of the Egner-Holmström microphone, which we mentioned last week, were succeeded on June 6th by tests conducted between the latter city and Cologne, which yielded results as favourable as those obtained between Berlin and Stockholm, notwithstanding that the distance of transmission was about 310 miles longer. The length, including submarine cables between Fehmarn and Laaland, and between Helsingor and Helsinborg, is calculated at 1,550 miles. During the experiments the current strength was lowered, and conversation was conducted with sufficient distinctness until the current was reduced to one-tenth of the normal. Successful trials have also been made with the microphone between Paris and Stockholm, a distance of 1,800 miles.

Panama.—The *Board of Trade Journal* states that the National Assembly of the Republic has authorised the expenditure of 500,000 fr. for the construction of telegraph lines and the establishment of telephonic communication between various towns, and also for wireless stations between Colon and Bocas del Toro.

Telegraph Codes.—With regard to the alterations in the telegraph code to foreign countries which come into effect on July 1st, the Postmaster-General states that permission is now given to combine figures and letters in a single group of five characters when denoting commercial marks, and arrangements have been made for the following reductions in rates from the United Kingdom:—To Austria the rate has been reduced from 3d. to 2½d.; Bulgaria, from 4d. to 3½d.; Crete 6d., 5½d.; Greece 6d., 5½d.; Hungary 3d., 2½d.; Italy 3d., 2½d.; Malta 4½d., 4d.; Morocco (Tangier) 4½d., 4d.; Roumania 3½, 3d.; Senegal 1s. 5d., 1s. 4½d.; Sweden 3½d., 3d.; Switzerland 3d., 2½d.; Turkey 6½d., 6d.

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Jamaica-Colon	May 6, 1909	
Dakar-Conakry	May 18, 1909	
Tangier-Cadiz	May 19, 1909	
Cayenne-Salinas	June 7, 1909	
Lowestoft-Nordeney	June 9, 1909	June 12, 1909
Paramaribo-Cayenne	June 8, 1909	
Rome-Constantinople	June 14, 1909	

Wireless Telegraphy.—*Nature* states that the U.S. Navy Department is about to construct, in Rock Creek Park, Washington, a concrete tower 600 ft. high, for the purposes of wireless telegraphy. The plant that will be installed is to send messages to a distance of 3,000 miles.

The Canadian Railway Commissioners, according to the *Telegraph Age*, have decided against the *Times*, which petitioned for reduced rates for Press matter transmitted by the Marconi Wireless Telegraph Co. It was desired to obtain the local Press rates on telegrams

"ELECTRICAL REVIEW"

	Locality.	Lines owned by	Year of opening.	Tramways Manager.	Tramways Electrical Engineer.	Miles of Route.	Gauge.	Weight of Rails per yard. lb.	Motor Cars.
1	ABERDEEN	Aberdeen Corporation	1899	R. Stuart Pilcher (Gen. Man.)	J. Alex. Bell	14.4	4ft. 8½in.	98	41 d.d., 28 s.
2	ABERDEEN & DISTRICT	Aberdeen Suburban Tramways Co.	1904	A. Wilkie (Man. Dir.)		5.5	4ft. 8½in.	95	6 d.d., 3 s.d
3	ACCRINGTON	Accrington Corporation	1907	James Wilson	Harold Gray	7.05	4ft. 0in.	95	16 d.d., 7 s.d
4	AIRDRIE AND COATBRIDGE	Airdrie & Coatbridge Tramways Co.	1904	A. Delves		3.63	4ft. 7¾in.	94	15 d.d.
5	ASHTON, DUKINFIELD, STALYBRIDGE & HYDE	Ashton-under-Lyne Corporation	1902	J. W. Dugdale (Eng. & Man.)	N. Appelbee	9	4ft. 8½in.	93	9 d.d., 6 s.d
6	AYR	Ayr Corporation	1901	W. Grant	W. Grant	6	4ft. 8½in.	90	6 comb. 19 d.d.
7	BARKING	Barking Urban District Council	1903	Henley L. Howard	Henley L. Howard	3.25*	4ft. 8½in.	80, 100 and 106	7 d.d.
8	BARNSLEY	Barnsley & District Electric Traction Co., Ltd.	1902	P. H. Marco	P. H. Marco	3.06	4ft. 8½in.	94	12 d.d., 1 s.d regen.
9	BARROW-IN-FURNESS	British Electric Traction Co., Ltd.	1904	W. F. Bladon		5.37	4ft. 0in.	94	9 d.d., 5 s.d. 2 demi-cars
10	BARTON-UPON-IRWELL	Barton-upon-Irwell R.D.C. (South Lancashire Tram. Co., Lessees)	1907	J. R. Salter	J. R. Salter	1.5	4ft. 8½in.	90	
11	BATH	Bath Electric Tramways, Ltd.	1904	W. E. Hardy (G. Man. & Eng.)	W. E. Hardy	14.75	4ft. 8½in.	95	34 d.d., comb.
12	BATLEY	Yorkshire (Woollen District) Electric Tramways, Ltd.	1908	E. A. Paris (Man. Director)	R. C. Goldston	7	4ft. 8½in.	104	
13	BELFAST	Belfast Corporation	1905	Andrew Nance	Thos. W. Bloxam	36.61	4ft. 8½in.	105	236 d.d.
14	BEXLEY	Bexley Urban District Council	1903	C. Mittelhausen	C. Mittelhausen	5.32	4ft. 8½in.	90	16 d.d.
15	BIDEFORD, WESTWARD HO! & APPLEDORE	Bideford, Westward Ho! and Appledore Railway Company	1901 & 1908	Henry Sowden	Henry Sowden	7	4ft. 8½in.	60 & 80	3 locomotive 6 s.d.
16	BIRKENHEAD	Birkenhead Corporation	1901	Wm. Wyld	Wm. Wyld	13.5	4ft. 8½in.	100	46 d.d., 13 s.
17	BIRMINGHAM	City of Birmingham Tramways Co.	1901	R. W. Cramp (Gen. Man.)	R. W. Cramp	18.18*	3ft. 6in.	90 & 97	152 d.d. (4 cable)
18	BIRMINGHAM	Birmingham Corporation	1904	Alfred Baker		34	3ft. 6in.	104	300 d.d.
19	BIRMINGHAM	Birmingham & Midland Tramways Ltd.	1905	R. W. Cramp (Gen. Man.)		12.1	3ft. 6in.		49 d.d., 8 s.d.
20	BLACKBURN	Blackburn Corporation	1899	James H. Cowell (Gen. Man.)		24.53	4ft. 0in.	92¼	48 d.d., 12 s.d 1 open car.
21	BLACKPOOL	Blackpool Corporation	1885	J. Lancaster (Man.) F. Field (Eng.)	Charles Furness	11.87	4ft. 8½in.	95	61 d.d.
22	BLACKPOOL & FLEETWOOD	Blackpool & Fleetwood Tramroad Company	1898	J. Cameron	Angus Cameron	8	4ft. 8½in.	98, 83 and 70	34 s.d.
23	BLACKPOOL, ST. ANNES & LYTHAM	Blackpool, St. Annes & Lytham Tramways Co., Ltd.	1903	Harry W. Laing	Harry W. Laing	7.5	4ft. 8½in.	90	40 d.d.
24	BOLTON	Bolton Corporation	1900	Arthur A. Day	Arthur A. Day	26.38	4ft. 8½in.	93	93 d.d.
25	BOOTLE	Bootle Corporation	1900	T. Dawson Clothier	T. Dawson Clothier	3.87	4ft. 8½in.	90	
26	BOURNEMOUTH, POOLE & CHRISTCHURCH	Bournemouth Corporation	1902	C. W. Hill (Gen. Man.)	I. Bulfin	21.5	3ft. 6in.	90, 100, 105	80 d.d., 1 saloo
27	BRADFORD	Bradford Corporation	1898	C. J. Spencer (G. Man. & Eng.)	C. J. Spencer	54.90	4ft. 0in.	102	238 d.d.
28	BRIGHTON	Brighton Corporation	1901	W. Marsh	W. Marsh	9.49	3ft. 6in.	101	50 d.d.
29	BRIGHTON BEACH	Volk's Electric Railway (Magnus Volk, Ltd.)	1883*	M. H. Volk	M. H. Volk	1.5	2ft. 8½in.	35	8 s.d.
30	BRISTOL	Bristol Tramways & Carriage Co., Ltd.	1895 (elec.)	Chas. Challenger	Sir J.C. Robinson	30.5	4ft. 8½in.	92½	234 d.d.
31	BURNLEY	Burnley Corporation	1903	H. Mozley	James E. Starkie	10.76	4ft. 0in.	102 & 105	43 d.d., 9 s.d
32	BURTON-ON-TRENT	Burton-on-Trent Corporation	1903	P. J. Pringle	P. J. Pringle	6.66*	3ft. 6in.	90	20 d.d.
33	BURTON, SWADLINCOTE, ASHBY AND CRESLEY	Midland Railway Co.	1906	James Toulmin	James Toulmin	12.02	3ft. 6in.	90	20 d.d.
34	BURY (LANCS.)	Bury Corporation	1903	William Clough	S. J. Watson	10.5	4ft. 8½in.	102¾	47 d.d.
35	CAMBORNE, REDRUTH AND ILLOGAN	Urban Electric Supply Co., Ltd., Camborne & Redruth Tramways	1902	L. A. Hards	L. A. Hards	4.5	3ft. 6in.	90	6 d.d., 2 s.d.
36	CAMBUSLANG, HAMILTON MOTHERWELL & WISHAW	Lanarkshire Tramways Co.	1903	G. F. Moller	G. F. Moller	17	4ft. 7¾in.	96 & 101	58 d.d.
37	CARDIFF	Cardiff Corporation	1902	Arthur Ellis	Arthur Ellis	17.61	4ft. 8½in.	100	100 d.d., 14 s.d 16 comb.
38	CARLISLE	City of Carlisle Electric Tramways Co., Ltd.	1900	J. McNee	J. B. Wilson	7	3ft. 6in.	87	12 d.d., 3 s.d
39	CAVEHILL AND WHITEWELL	Cavehill & Whitewell Tramway Co.	1906	F. P. Comber		3.29	4ft. 9in.	105	8 d.d.
40	CHATHAM, GILLINGHAM, RAINHAM ROCHESTER	Chatham District Light Railways Co.	1902	W. Jensen	J. C. Whiteley	14.98	3ft. 6in.	95 to 105	45 d.d.
41	CHELTENHAM & DISTRICT	Cheltenham and District Light Railway Co.	1901	H. J. McCormick		10.25	3ft. 6in	88 & 90	18 d.d., 2 s.d
42	CHESTER	Chester Corporation	1903	J. Gardner	S. E. Britton	3.62	3ft. 6in.	92 & 100	17 d.d., 1 d.c (inc. 6 regen.
43	CHESTERFIELD	Chesterfield Corporation	1904	R. L. Acland	R. L. Acland	3.62	4ft. 8½in.	96	14 d.d.
44	CLONTARF	Clontarf & Hill of Howth Tramroad Co.	1900	C. W. Gordon	P. S. Sheardown	5.5	5ft. 3in.	60, 83, 95	12 d.d.
45	COLCHESTER	Colchester Corporation	1904	R. C. Bullough	A. R. Sillar	6	3ft. 6in.	95	18 d.d.
46	COLNE AND TRAWDEN	Colne and Trawden Light Railways Co.	1908	Marten Turner	Marten Turner	5.19	4ft. 0in.	103	12 d.d.
47	CORK	Cork Electric Tramways & Lighting Co., Ltd.	1898	H. G. Whiting	H. H. Naider	9.89	2ft. 11½in.	88	35 d.d.
48	CROYDON	Croydon Corporation	1901	T. B. Goodyer	H. B. Harris	13	4ft. 8½in.	95 & 102	70 d.d.
49	COVENTRY	Coventry Electric Tramways Co.	1895, '98, & 1905	T. R. Whitehead	I. E. Winslow (Cons. Eng.)	13.25	3ft. 6in.	81 & 65	36 d.d.
50	DARLINGTON	Darlington Corporation	1904	J. R. P. Lunn	J. R. P. Lunn	4.87	3ft. 6in.	90	16 s.d.
51	DARTFORD, STONE AND CRAYFORD	J. G. White & Co., Ltd. (Lessees)	1906	A. G. Balfour (Acting)	A. G. Balfour	6.5	4ft. 8½in.	100	12 d.d.
52	DARWEN	Darwen Corporation	1900	R.W. Smith-Saville (Gen. Man. & Eng.)	R. W. S.-Saville C. Garnett	4.25	4ft. 0in.	95½	14 d.d., 3 s.d regen.
53	DERBY	Derby Corporation	1904	F. Harding	P. P. Wilmshurst	12.57	4ft. 0in.	93	43 d.d., 4 s.d
54	DEVONPORT AND DISTRICT	Devonport & District Tramways Co.	1901	C. W. Durnford	C. W. Durnford	8.85	3ft. 6in.	92	25 d.d.
55	DONCASTER	Doncaster Corporation	1902	E. S. Rayner	E. S. Rayner	8.3	4ft. 8½in.	100	25 d.d.
56	DOVER AND RIVER	Dover Corporation	1897	Edward Carden (G. M. & Elec. Eng.)	W. C. Hawke (Boro' Eng., P. W.)	4.75	3ft. 6in.	90 & 87	21 d.d.
57	DUBLIN	Dublin United Tramways Co. (1896) Ltd.	1896	C. W. Gordon	P. S. Sheardown	54	5ft. 3in.	105	330 d.d., s.d.
58	DUBLIN AND LUCAN	Dublin & Lucan Electric Railway Co.	1900	H. Harrison	H. Harrison	6.75	3ft. 6in.	50	6 d.d., 1 loco 18 wagon
59	DUDLEY, STOURBRIDGE AND DISTRICT	Dudley Stourbridge and District Electric Traction Co., Ltd.	1899	R. W. Cramp (Gen. Man.)		32.42	3ft. 6in.	90	244 d.d., 35 s.d
60	DUMBARTON AND DISTRICT	Dumbarton Burgh and County Tramways Co., Ltd.	1907	Joseph McMahon	Joseph McMahon	13	4ft. 7¾in.	90	6 d.d., 24 com

EW" LIST OF ELECTRIC TR

OF THE UNIT

Gauge.	Weight of Rails per yard. lb.	Motor Cars.	Power Station. Total Capacity in KW.	Power Station. Max. load in KW.	Power Station. Battery max. discharge.	Capital Outlay on Tramway and Rolling Stock.	Capital Outlay on Power Station.	Annual Electric Car Mileage.	Passengers Carried per Annum.	Remarks.	
4ft. 8½in.	98	41 d.d., 28 s.d.	3,801*	655 ave.	..	£319,978	*	1,566,119	17,519,304	*Lighting and traction station. Data to May 31, 1908	1
4ft. 8½in.	95	6 d.d., 3 s.d.	*	..	..	£41,750	*	113,856	721,021	*Energy purchased from Aberdeen Corporation. Data to Jan. 31, 1909	2
4ft. 0in.	95	16 d.d., 7 s.d.	*	..	..	£126,575	*	482,259	3,801,879	*Lighting and traction station. Data to Mar. 31, 1909	3
4ft. 7½in.	94	15 d.d. ..	*	..	..	£67,200	*	277,817	2,843,982	* Energy purchased from Coatbridge and Airdrie Electric Supply Co., Ltd. Data to Dec. 31, 1908	4
4ft. 8½in.	93	9 d.d., 6 s.d., 6 comb.	1,760*	890	..	£104,000	£73,389	46,000	5,400,000	*Lighting and traction station	5
4ft. 8½in.	90	19 d.d. ..	1,175*	750	100 KW.	£80,000	£96,000*	387,883	3,660,038	*Lighting and traction station. Data to May 15, 1908..	6
4ft. 8½in.	80, 100 and 106	7 d.d. ..	850†	584	..	£56,000*	£23,000†	105,000	1,280,420	* ¾ m. leased to East Ham. † Lighting and traction station	7
4ft. 8½in.	94	12 d.d., 1 s.d. regen.	*	..	..	£67,404	*	196,314	1,800,308	*Energy purchased from Barnsley Corporation. Data to Dec. 31, 1907	8
4ft. 0in.	94	9 d.d., 5 s.d., 2 demi-cars	*	..	..	..	*	334,055	3,187,109	*Energy purchased from Corporation of Barrow-in-Furness. Data to Dec. 31, 1907	9
4ft. 8½in.	90	.. ..	..	..	..	£13,000	..	*	*	*Receipts, passengers &c. included in South Lancashire Tramway returns	10
4ft. 8½in.	95	34 d.d., 6 comb.	675	..	..	£347,711		956,128	6,241,875	Twelve motor omnibuses in use. Data to Dec. 30, 1908	11
4ft. 8½in.	104	.. .. ..	850*	350	90 KW.	..	£42,871*	†	†	*Lg. & tr. stn. of the Batley Corp. †Run in conj. with adjoining lines of the Co. Data to Dec. 31, 1907	12
4ft. 8½in.	105	236 d.d. ..	4,200*	2,860	..	£605,550	£87,159*	5,808,901	45,233,122	*Lg. & tr. stn.; 1,200 KW. available for both purposes; 2,000 KW. on order. Data to Mar. 31, 1908	13
4ft. 8½in.	90	16 d.d. ..	480 (tr.)*	220	37 KW.	£74,015	£27,025†	254,364§	1,540,635	*Tramway station supplying energy for lighting. †Lg. £5,137, tr. £21,888. §Bexley cars only. Data to Mar./08	14
4ft. 8½in.	60 & 80	3 locomotives, 6 s.d. ..	..	..	..	..	..	..	..	.. ..	15
4ft. 8½in.	100	46 d.d., 13 s.d.	1,475	1,250	201.6 KW.	..	..	1,278,015	12,038,582	Data to Mar. 31, 1909	16
4ft. 6in.	90 & 97	152 d.d. (48 cable)	1,098†	..	..	£534,029 (inc. cable)	..	2,220,961	25,301,755	*6⅔ miles leased from Aston Corporation. †Two stations. Data to Dec. 31, 1907	17
4ft. 6in.	104	300 d.d. ..	*	..	..	£936,000	*	6,011,788	75,601,195	*Energy purchased from Birmingham Corporation Electricity Department. Data to Mar. 31, 1909	18
4ft. 6in.	..	49 d.d., 8 s.d.	3,530	..	..	£453,656	..	1,002,124	11,006,985	Data to Dec. 31, 1908	19
4ft. 0in.	92¼	48 d.d., 12 s.d. 1 open car.	4,518*	..	..	£334,003	*	1,182,023	10,737,528	*Lighting and traction station. Energy purchased from Elec. Dept. at 1.4d. per unit. Data to Mar. 25, 1909	20
4ft. 8½in.	95	61 d.d. ..	1,800*	758	1,680 A.H.	£282,631	£199,060*	945,229	8,143,722	*Lighting and traction station	21
4ft. 8½in.	98, 83 and 70	34 s.d. ..	600	480	380 KW.	£198,479		538,823	2,615,528	Data to Dec. 31, 1908	22
4ft. 8½in.	90	40 d.d. ..	760*	476	..	..	..	580,000	2,980,000	*Lighting and traction station	23
4ft. 8½in.	93	93 d.d. ..	7,600*	1,800	..	£477,426	£325,987*	2,556,511	25,978,440	*Lighting and traction station. Data to Mar. 31, 1909	24
4ft. 8½in.	90	*	2,050†	350 (tr. only)	150 KW.	£75,616	£17,227†	*	*	*Running leased to Liverpool Corporation. †Lighting and traction station. Data to Mar. 31, 1909	25
4ft. 6in.	90, 100, 105	80 d.d., 1 saloon	1,200	1,000	..	£390,224		1,743,035	13,671,351	1.35 miles double-track conduit. Power for Poole and Christchurch supplied by Co. Data to Mar. 31, 1909	26
4ft. 0in.	102	238 d.d. ..	*	..	..	£914,723	*	5,376,228	47,655,106	*Lighting & traction station, energy purchased from Elec. Dept. at 1½d. per unit. Data to Mar. 31, 1909	27
4ft. 6in.	101	50 d.d. ..	7,300	1,270	550 KW.	£274,905	*	1,109,584	10,034,965	*Lighting and traction station; energy purchased from Electricity Department. Data to Mar. 31, 1909	28
4ft. 8½in.	35	8 s.d. ..	60†	40†	36 KW.	£10,000		80,000	700,000	*Pioneer of electric traction in Great Britain. †Power from Brighton Corp. also. Data to Apr. 22, 1908	29
4ft. 8½in.	92½	284 d.d. ..	2,150	..	..	£1,491,453	..	5,727,943 (1907)	46,652,389	Data for 1908	30
4ft. 0in.	102 & 105	43 d.d., 9 s.d.	1,990*	1,040	190 KW.	£234,583 inclusive	*	1,229,224	12,176,782	*Lighting and traction station; energy purchased from Burnley and Nelson Corps. Data to Mar. 31, 1909	31
4ft. 6in.	90	20 d.d. ..	1,710†	375 (tr. only)	..	£93,046	£81,471†	425,843	3,020,805	*1 mile leased to Midland Railway Co. † Lighting and traction station. Data to Mar. 31, 1909	32
4ft. 6in.	90	20 d.d. ..	330	..	440 A.	..	..	..	..	Data to April 16, 1909	33
4ft. 8½in.	102¾	47 d.d. ..	1,360*	715	..	£278,980	*	1,483,626	11,181,120	*Lighting and traction station. Data for 1907-8 ..	34
4ft. 6in.	90	6 d.d., 2 s.d.*	1,025†	540	150 KW.	£53,646	£53,403	152,712	1,340,035	*2 electric locos. & 16 wagons, 247 tons of tin ore daily. †Lg. & tr. stn.; 100 KW. for tr. Data to Dec. 31, 1908	35
4ft. 7½in.	96 & 101	53 d.d. ..	825	972	..	£271,370*	£55,423	1,648,918	12,905,378	*Excluding preliminary expenses, street improvements, &c. Data to Dec. 31, 1908	36
4ft. 8½in.	100	100 d.d., 14 s.d., 16 comb.	5,400*	2,637	150 KW.	£767,108 inclusive	..	2,529,617	25,493,389	Energy sold to Lighting Department at 0.82d. per unit. *Includes lighting load & plant. Data to Mar. 31, 1909	37
4ft. 6in.	87	12 d.d., 3 s.d.	*	..	..	£101,183	*	353,012	2,600,210	*Energy purchased from Carlisle Corporation. Data to Dec. 31, 1908	38
4ft. 9in.	105	8 d.d. ..	*	..	..	£67,211	*	125,354	497,766	*Energy purchased from Belfast Corporation. Data to Dec. 31, 1908	39
4ft. 6in.	95 to 105	45 d.d. ..	675	660	..	£188,167	£63,000 inc. car shed	1,099,164	8,098,042	*Also Strood, Frindsbury, Delce and Borstal, leased from Rochester Corporation. Data to Dec. 31, 1909	40
4ft. 6in	88 & 90	18 d.d., 2 s.d.	*	..	..	£120,000	*	507,887	2,895,765	*Energy purchased from Cheltenham Corporation lighting & traction station. Data to Aug. 16, 1908	41
4ft. 6in.	92 & 100	17 d.d., 1 d.e. (inc. 6 regen.)	1,325*	1,320	154 KW.	£82,848	£117,185*	342,342	2,975,590	*Lighting and traction station	42
4ft. 8½in.	93	14 d.d. ..	1,000*	300	..	£69,792	£7,000†	282,228	2,450,000	*Lighting and traction station. †Extra outlay for traction	43
5ft. 3in.	60, 83, 95	12 d.d. ..	*	..	..	£72,500	*	152,000	524,000	*Energy supplied by Dublin United Tramways Co. ..	44
4ft. 6in.	95	18 d.d. ..	*	..	..	£69,555	*	330,013	1,970,489	*Lighting and traction station. Energy purchased from Corporation at 1½d. per unit. Data to Mar. 31, 1909	45
4ft. 0in.	103	12 d.d. ..	*	..	..	..	*	310,554	2,130,788	*Energy purchased from Colne Corporation. Data to Dec. 31, 1907	46
4ft. 11½in.	83	35 d.d. ..	2,350*	400 (tr. only)	..	£178,018	*	896,945	5,737,478	*Lighting and traction station	47
4ft. 8½in.	95 & 102	70 d.d. ..	1,950*	650	..	£257,176	*	1,884,187	16,277,418	*Lighting and traction station. Tramways taken over from Company, June, 1908	48
4ft. 6in.	81 & 65	36 d.d. ..	700	..	..	£197,675		864,223	5,326,081	65-lb. rails Falk welded, 81-lb. rails Thermit welded. Data to Dec. 31, 1908	49
4ft. 6in.	90	16 s.d. ..	*	306.8	..	£76,269	*	378,344	2,600,957	*Lighting and traction station. Energy purchased from Corp. Electricity Department. Data to Mar. 31, 1909	50
4ft. 8½in.	100	12 d.d. ..	*	..	..	..	*	317,197	2,055,033	*Energy purchased from Dartford U. D. C. Data to Mar. 25, 1908	51
4ft. 0in.	95½	14 d.d., 3 s.d. regen.	900*	300	92 KW.	£91,000	*	240,000	2,450,000	*Lighting and traction station. Data to Mar. 31, 1909..	52
4ft. 6in.	95	48 d.d., 4 s.d.	1,100*	500	170 KW.	£223,509	£13,000* (tr. only)	961,886	8,775,686	*Lighting and traction station. Energy purchased from Electricity Committee. Data to Mar. 31, 1908	53
4ft. 6in.	92	25 d.d. ..	*	..	..	£162,337	*	590,478	5,410,685	4½ miles leased from Corporation. * Energy purchased from Devonport Corporation. Data to Dec. 31, 1908	54
4ft. 8½in.	100	25 d.d. ..	1,040*	500	..	£96,642	*	479,825	2,866,912	*Lighting and traction station; energy supplied at 1½d. per unit. Data to Mar. 31, 1909	55
4ft. 6in.	90 & 87	21 d.d. ..	200* (tr. only)	..	280 KW.-hours	£63,850	*	314,378	2,472,041	River Light Rly. figures included. *Lighting and traction station. Data to Mar. 31, 1909	56
5ft. 3in.	105	330 d.d., 3 s.d.	4,300*	2,967	..	£1,998,558	..	7,380,576	51,512,905	*A.C. 2,500v. 3ph. to sub-stations, D.C. to line at 500v. Data for 1906-7.	57
4ft. 6in.	80	6 d.d., 1 loco., 18 wagons	240	200	..	£69,254*	..	140,580	403,086	* Including conversion & alteration of gangs. Data to Dec. 31, 1908	58
4ft. 6in.	90	24d.d., 35 s.d.	500	..	325 KW.	£375,706	..	912,266	7,649,698	Part power supplied by Dudley Corp., also by Midland Corporation for E. P. D. Data to Dec. 31, 1908	59
4ft. 7½in.	90	6 d.d., 24 comb.	*	41	..	..	*	402,489†	1,842,093†	*Energy purchased from Electric Supply Corporation Ltd. Data from Aug. 1, 1908, to Mar. 31, 1909.	60

20	BLACKBURN	Blackburn Corporation	1899	James H. Cowell (Gen. Man.)		24.53	4ft. 0in.	92½	48 d.d., 1 1 open
21	BLACKPOOL	Blackpool Corporation	1885	J. Lancaster (Man.) F. Field (Eng.)	Charles Furness	11.87	4ft. 8½in.	95	61 d.d.
22	BLACKPOOL & FLEETWOOD	Blackpool & Fleetwood Tramroad Company	1898	J. Cameron	Angus Cameron	8	4ft. 8½in.	98, 83 and 70	34 s.d.
23	BLACKPOOL, ST. ANNES & LYTHAM	Blackpool, St. Annes & Lytham Tramways Co., Ltd.	1903	Harry W. Laing	Harry W. Laing	7.5	4ft. 8½in.	90	40 d.d.
24	BOLTON	Bolton Corporation	1900	Arthur A. Day	Arthur A. Day	25.38	4ft. 8½in.	93	93 d.d.
25	BOOTLE	Bootle Corporation	1900	T. Dawson	T. Dawson Clothier	3.87	4ft. 8½in.	90	"
26	BOURNEMOUTH, POOLE & CHRISTCHURCH	Bournemouth Corporation	1902	C. W. Hill (Gen. Man.)	I. Bulfin	21.5	3ft. 6in.	90, 100, 105	80 d.d., 1 s
27	BRADFORD	Bradford Corporation	1898	C. J. Spencer (G. Man. & Eng.)	C. J. Spencer	54.90	4ft. 0in.	102	238 d.d.
28	BRIGHTON	Brighton Corporation	1901	W. Marsh	W. Marsh	9.49	3ft. 6in.	101	50 d.d.
29	BRIGHTON BEACH	Volk's Electric Railway (Magnus Volk, Ltd.)	1883*	M. H. Volk	M. H. Volk	1.5	2ft. 8½in.	35	8 s.d.
30	BRISTOL	Bristol Tramways & Carriage Co., Ltd.	1895 (elec.)	Chas. Challenger	Sir J.C. Robinson	30.5	4ft. 8½in.	92½	234 d.d.
31	BURNLEY	Burnley Corporation	1902	H. Mozley	James E. Starkie	10.76	4ft. 0in.	102 & 105	48 d.d., 9
32	BURTON-ON-TRENT	Burton-on-Trent Corporation	1903	P. J. Pringle	P. J. Pringle	6.66*	3ft. 6in.	90	20 d.d.
33	BURTON, SWADLINCOTE, ASHBY AND CRESLEY	Midland Railway Co.	1906	James Toulmin	James Toulmin	12.02	3ft. 6in.	90	29 d.d.
34	BURY (LANCS.)	Bury Corporation	1903	William Clough	S. J. Watson	10.5	4ft. 8½in.	102½	47 d.d.
35	CAMBORNE, REDRUTH AND ILLOGAN	Urban Electric Supply Co., Ltd., Camborne & Redruth Tramways	1902	L. A. Hards	L. A. Hards	4.5	3ft. 6in.	90	6 d.d., 2
36	CAMBUSLANG, HAMILTON MOTHERWELL & WISHAW	Lanarkshire Tramways Co.	1903	G. F. Moller	G. F. Moller	17	4ft. 7¾in.	98 & 101	58 d.d.
37	CARDIFF	Cardiff Corporation	1902	Arthur Ellis	Arthur Ellis	17.61	4ft. 8½in.	100	100 d.d., 1 16 com
38	CARLISLE	City of Carlisle Electric Tramways Co., Ltd.	1900	J. McNee	J. B. Wilson	7	3ft. 6in.	87	12 d.d., 3
39	CAVEHILL AND WHITEWELL	Cavehill & Whitewell Tramway Co.	1905	F. P. Comber		3.29	4ft. 9in.	105	8 d.d.
40	CHATHAM, GILLINGHAM, RAINHAM ROCHESTER	Chatham District Light Railways Co.	1902	W. Jensen	J. C. Whiteley	14.98	3ft. 6in.	95 to 105	45 d.d.
41	CHELTENHAM & DISTRICT	Cheltenham and District Light Railway Co.	1901	H. J. McCormick		10.25	3ft. 6in	88 & 90	18 d.d., 2
42	CHESTER	Chester Corporation	1903	J. Gardner	S. E. Britton	3.62	3ft. 6in.	92 & 100	17 d.d., 1 (inc. 6 re
43	CHESTERFIELD	Chesterfield Corporation	1904	R. L. Acland	R. L. Acland	3.62	4ft. 8½in.	93	14 d.d.
44	CLONTARF	Clontarf & Hill of Howth Tramroad Co.	1900	C. W. Gordon	P. S. Sheardown	5.5	5ft. 3in.	60, 83, 95	12 d.d.
45	COLCHESTER	Colchester Corporation	1904	R. C. Bullough	A. R. Sillar	6	3ft. 6in.	95	18 d.d.
46	COLNE AND TRAWDEN	Colne and Trawden Light Railways Co.	1903	Marten Turner	Marten Turner	5.19	4ft. 0in.	103	12 d.d.
47	CORK	Cork Electric Tramways & Lighting Co., Ltd.	1898	H. G. Whiting	H. H. Nalder	9.89	2ft. 11½in.	83	35 d.d.
48	CROYDON	Croydon Corporation	1901	T. B. Goodyer	H. B. Harris	13	4ft. 8½in.	95 & 102	70 d.d.
49	COVENTRY	Coventry Electric Tramways Co.	1895, '98, & 1905	T. R. Whitehead	I. E. Winslow (Cons. Eng.)	13.25	3ft. 6in.	81 & 65	36 d.d.
50	DARLINGTON	Darlington Corporation	1904	J. R. P. Lunn	J. R. P. Lunn	4.87	3ft. 6in.	90	16 s.d.
51	DARTFORD, STONE AND CRAYFORD	J. G. White & Co., Ltd. (Lessees)	1906	A. G. Balfour (Acting)	A. G. Balfour	6.5	4ft. 8½in.	100	12 d.d.
52	DARWEN	Darwen Corporation	1900	R. W. Smith-Saville (Gen. Man. & Eng.)	R. W. S.-Saville C. Garnett	4.25	4ft. 0in.	95½	14 d.d., regen.
53	DERBY	Derby Corporation	1904	F. Harding	F. P. Wilmshurst	12.57	4ft. 0in.	95	43 d.d.,
54	DEVONPORT AND DISTRICT	Devonport & District Tramways Co.	1901	C. W. Durnford	C. W. Durnford	8.85	3ft. 6in.	92	23 d.d.
55	DONCASTER	Doncaster Corporation	1902	E. S. Rayner	E. S. Rayner	8.3	4ft. 8½in.	100	25 d.d.
56	DOVER AND RIVER	Dover Corporation	1897	Edward Carden (G. M. & Elec. Eng.)	W. C. Hawke (Boro' Eng., P. W.)	4.75	3ft. 6in.	90 & 87	21 d.d.
57	DUBLIN	Dublin United Tramways Co. (1896) Ltd.	1896	C. W. Gordon	P. S. Sheardown	54	5ft. 3in.	105	330 d.d. s.d.
58	DUBLIN AND LUCAN	Dublin & Lucan Electric Railway Co.	1900	H. Harrison	H. Harrison	6.75	3ft. 6in.	50	6 d.d., 1 18 wa
59	DUDLEY, STOURBRIDGE AND DISTRICT	Dudley Stourbridge and District Electric Traction Co., Ltd.	1899	R. W. Cramp (Gen. Man.)		22.42	3ft. 6in.	90	24d.d.,36
60	DUMBARTON AND DISTRICT	Dumbarton Burgh and County Tramways Co., Ltd.	1907	Joseph McMahon	Joseph McMahon	13	4ft. 7¾in.	90	6 d.d., 24
61	DUNDEE	Dundee Corporation	1900 (elec.)	Peter Fisher	H. Richardson	14½	4ft. 8½in.	94 to 100	60 d.d. comb
62	DUNDEE AND DISTRICT	Dundee, Broughty Ferry & District Tramways Co., Ltd.	1905	J. H. Shepherd	J. H. Shepherd	5	4ft. 8½in.	90	14 d.d.
63	EAST HAM	East Ham Corporation	1901	W. C. Ullmann	W. C. Ullmann	6.84	4ft. 8½in.	90	40 d.d.
64	ECCLES	Eccles Corporation, leased to and worked by Salford Corporation	1902	G. W. Holford (Tr. Man., Salford).	H. W. Angus (El. Eng., Eccles).	5.12	4ft. 8½in.	102	11 d.d.
65	ERITH	Erith Urban District Council	1905	Arthur Coveney	Arthur Coveney	4.75	4ft. 8½in	109	14 d.d., regen.
66	EXETER	Exeter Corporation	1905	H. C. Bartlett	H. D. Munro	4.25	3ft. 6in.	..	14 d.d.
67	FALKIRK AND DISTRICT	Falkirk and District Tramways Co.	1905	D. Hays	D. Hays	6.21	4ft. 0in.	90	18 d.d.
68	FARNWORTH	Farnworth Urban District Council (leased to S. Lane. Tramways Co.)	1901	J. R. Salter	R. B. Leach	4.38	4ft. 8½in.	98	13 d.d.
69	FELIXSTOWE PIER	Coast Development Corporation	1905	H. Wood	E. A. Lambert	0.5	3ft. 6in.	36	2 moto trail
70	GATESHEAD, FELLING AND WHICKHAM	Gateshead & District Tramways Co.	1901	W. Morrison		11.28	4ft. 8½in.	90	25 d.d., 1 11 con
71	GIANT'S CAUSEWAY & PORTRUSH	Giant's Causeway and Portrush Electric Tramway Co.	1883	D. Fall	W. A. Traill	8	3ft. 0in.	48	3 s.d., 1
72	GLASGOW	Glasgow Corporation	1898	James Dalrymple	J. Ferguson (Chf.) E. S. Goslin (El.)	94.8	4ft. 7¾in.	110	768 d.d.
73	GLOSSOP	Urban Electric Supply Co., Ltd.	1903	C. E. Knowles	C. E. Knowles	4.5	4ft. 8½in.	90	7 d.d., 1
74	GLOUCESTER	Gloucester Corporation	1904	Leonard Johnston	Leonard Johnston	9	3ft. 6in.	90	30 d.d.
75	GOSPORT & FAREHAM	Provincial Tramways Co., Ltd.	1906	J. Fereday Glenn	J. Fereday Glenn J. Glenn (Cons.)	6.12	4ft. 7¾in.	95	22 d.d.
76	GRAVESEND, NORTHFLEET AND SWANSCOMBE	Gravesend and Northfleet Electric Tramways Ltd.	1902	P. N. Gray	J. Creagh	6.5	4ft. 8½in.	87	16 d.d.,
77	GREENOCK AND PORT GLASGOW	Greenock & Port Glasgow Tramways Co.	1901	G. W. King		7.42	4ft. 7¾in.	92	40 (1 de
78	GRIMSBY & CLEETHORPES	Gt. Grimsby Street Tramways Co.	1902	H. L. White	H. L. White	6	4ft. 8½in.	90	32 d.d.
79	GUERNSEY ST. PETER PORT & ST. SAMPSON'S	Guernsey Railway Co., Ltd.	1892	A. G. Bird	A. G. Bird	3.5	4ft. 8½in.	40, 74 & 84	9 d.d., 1 8 trai
80	HALIFAX	Halifax Corporation	1898	W. M. Rogerson	W. M. Rogerson	37.4	3ft. 6in.	95	93 d.d.,
	HARTLEPOOL, EAST & WEST & SEATON CAREW	Hartlepool Electric Tramways Co., Ltd.	1896	George Cardwell	George Cardwell	6.72	3ft. 6in.	90	21 d.d.
82	HASTINGS, ST. LEONARDS AND BEXHILL	Hastings Tramways Co.	1905	Thos. B. Holliday	Thos. B. Holliday	19.5*	3ft. 6in.	90	65 d.d.
83	HASLINGDEN	Haslingden Corporation	1908	Barnes Kay		3	4ft. 0in.	100	..
84	HERNE BAY PIER	Herne Bay Pier Co., Ltd.	1896	Henry C. Dufton	Henry C. Dufton (Res. Eng.)	0.75	3ft. 0in.	60	3 s.d.
85	HEYWOOD	Heywood Corp. owner; Bury and Rochdale Corporations, lessees	1905	J. C. Ramsbottom	Jas. Stott	4.25	4ft. 8½in.	90	"
86	HUDDERSFIELD	Huddersfield Corporation	1901	R. H. Wilkinson	R. H. Wilkinson	28	4ft. 7¾in.	98 & 105	70 d.d.
87	HULL	Hull Corporation	1899	W. J. McCombe	J. Wilkinson	16	4ft. 8½in.	94	116 d.d
88	ILFORD	Ilford Urban District Council	1903	A. Woolstencroft (Traffic Sup.)	A. H. Shaw	6.62	4ft. 8½in.	100	22 d.d bogie
89	ILKESTON	Ilkeston Corporation	1903	A. C. Gilbert	A. C. Gilbert	3.5	3ft. 6in.	90	13 d.d.
90	IPSWICH	Ipswich Corporation	1903	F. Ayton	F. Ayton	10.8	3ft. 6in.	90	36 d.d.
91	ISLE OF MAN: (1) DOUGLAS-RAMSEY (2) SNAEFELL MOUNTAIN	Manx Electric Railway Co., Ltd.	1893, '94 1896 1905	F. Edmondson (Gen. Man.)	F. Edmondson	18 4.5	3ft. 0in. 3ft. 6in.	56 & 62½ 36	37 mr., (s.d. 2 sat
	(3) DOUGLAS SOUTHERN	Douglas Southern Electric Tramways Ltd.	1896	R. Orton	R. Orton	3.5	4ft. 8½in.	65	8 d.d.
92	ISLE OF THANET	Isle of Thanet Electric Tramways & Lighting Co., Ltd.	1901	J. A. Forde	J. A. Forde	11.5	3ft. 6in.	90	60 d.d.
93	JARROW AND DISTRICT	Jarrow & District Electric Traction Co., Ltd.	1906	W. Morrison (Man. Dir.)	G. McClelland (Supt.)	2.54	4ft. 8½in.	95	10 d.d.
94	KEIGHLEY	Keighley Corporation	1904	J. W. Bamber	J. M. Smyth (Power Station)	3.27	4ft. 0in.	95	12 motor

											10
4ft. 0in.	92¼	48 d.d., 12 s.d. 1 open car.	4,518*	..	..	£334,003	*	1,192,023	10,737,528	*Lighting and traction station. Energy purchased from Elec. Dept. at 1.4d. per unit. Data to Mar. 25, 1909	20
4ft. 8½in.	95	61 d.d. ..	1,800*	758	1,680 A.H.	£282,631	£199,060*	945,229	8,143,722	*Lighting and traction station	21
4ft. 8½in.	98, 83 and 70	34 s.d. ..	600	480	380 KW.	£198,479		538,823	2,615,528	Data to Dec. 31, 1908	22
4ft. 8½in.	90	40 d.d. ..	760*	476	..	..	..	580,000	2,980,000	*Lighting and traction station	23
4ft. 8½in.	93	93 d.d. ..	7,600*	1,800	..	£477,426	£325,987*	2,556,511	25,978,440	*Lighting and traction station. Data to Mar. 31, 1909	24
4ft. 8½in.	90	*	2,050†	350 (tr. only)	150 KW.	£75,616	£17,227†	*	*	*Running leased to Liverpool Corporation. †Lighting and traction station. Data to Mar. 31, 1909	25
3ft. 6in.	90, 100, 105	80 d.d., 1 saloon	1,200	1,000	..	£390,224		1,743,085	18,671,351	1.35 miles double-track conduit. Power for Poole and Christchurch supplied by Co. Data to Mar. 31, 1909	26
4ft. 0in.	102	238 d.d. ..	*	..	..	£914,723	*	5,876,228	47,655,106	*Lighting & traction station, energy purchased from Elec. Dept. at 1½d. per unit. Data to Mar. 31, 1909	27
3ft. 6in.	101	50 d.d. ..	7,200	1,270	550 KW.	£274,905	*	1,109,584	10,034,965	*Lighting and traction station; energy purchased from Electricity Department. Data to Mar. 31, 1909	28
2ft. 8½in.	35	8 s.d. ..	60†	40†	36 KW.	£10,000		80,000	700,000	*Pioneer of electric traction in Great Britain. †Power from Brighton Corp. also. Data to Apr. 22, 1908	29
4ft. 8½in.	92½	234 d.d. ..	2,150	..	..	£1,491,453	..	5,727,943 (1907)	46,652,389	Data for 1908	30
4ft. 0in.	102 & 105	43 d.d., 9 s.d.	1,990*	1,040	190 KW.	£234,588 inclusive	*	1,229,224	12,176,782	*Lighting and traction station; energy purchased from Burnley and Nelson Corps. Data to Mar. 31, 1909	31
3ft. 6in.	90	20 d.d. ..	1,710†	375 (tr. only)	..	£93,046	£81,471†	425,843	3,030,805	*1 mile leased to Midland Railway Co. † Lighting and traction station. Data to Mar. 31, 1909	32
3ft. 6in.	90	20 d.d. ..	330	..	440 A.	..	..	..	..	Data to April 16, 1909	33
4ft. 8½in.	102¾	47 d.d. ..	1,360*	715	..	£278,880	*	1,486,626	11,181,120	*Lighting and traction station. Data for 1907-8 ..	34
3ft. 6in.	90	6 d.d., 2 s.d.*	1,025†	540	150 KW.	£53,646	£53,403	152,712	1,340,035	*2 electric locos. & 16 wagons, 247 tons of tin ore daily. †Lg. & tr. stn.; 100 KW. for tr. Data to Dec. 31, 1908	35
4ft. 7¾in.	96 & 101	58 d.d. ..	825	972	..	£271,370*	£55,423	1,648,913	12,905,378	*Excluding preliminary expenses, street improvements, &c. Data to Dec. 31, 1908	36
4ft. 8½in.	100	100 d.d., 14 s.d., 16 comb.	5,400*	2,637	150 KW.	£767,108 inclusive	..	2,529,617	25,493,389	Energy sold to Lighting Department at 0.82d. per unit. *Includes lighting load & plant. Data to Mar. 31, 1909	37
3ft. 6in.	87	12 d.d., 3 s.d.	*	..	..	£101,183	*	353,012	2,600,210	*Energy purchased from Carlisle Corporation. Data to Dec. 31, 1908	38
4ft. 9in.	105	8 d.d. ..	*	..	..	£67,211	*	125,354	497,766	*Energy purchased from Belfast Corporation. Data to Dec. 31, 1908	39
3ft. 6in.	95 to 105	45 d.d. ..	675	630	..	£188,167	£63,000 inc. car shed	1,099,164	8,098,042	*Also Strood, Frindsbury, Delce and Borstal, leased from Rochester Corporation. Data to Dec. 31, 1909	40
3ft. 6in	88 & 90	18 d.d., 2 s.d.	*	..	..	£120,000	*	507,387	2,895,765	*Energy purchased from Cheltenham Corporation lighting & traction station. Data to Aug. 16, 1908	41
3ft. 6in.	92 & 100	17 d.d., 1 d.s. (inc. 6 regen.)	1,325*	1,320	154 KW.	£82,848	£117,185*	342,342	2,975,590	*Lighting and traction station	42
4ft. 8½in.	93	14 d.d. ..	1,000*	300	..	£69,792	£7,000†	282,228	2,450,000	*Lighting and traction station. †Extra outlay for traction	43
5ft. 3in.	60, 83, 95	12 d.d. ..	*	..	..	£72,500	*	152,000	524,000	*Energy supplied by Dublin United Tramways Co. ..	44
3ft. 6in.	95	18 d.d. ..	*	..	..	£69,555	*	330,013	1,970,489	*Lighting and traction station. Energy purchased from Corporation at 1½d. per unit. Data to Mar. 31, 1909	45
4ft. 0in.	103	12 d.d. ..	*	..	..	..	*	310,554	2,130,788	*Energy purchased from Colne Corporation. Data to Dec. 31, 1907	46
2ft. 11½in.	83	35 d.d. ..	2,350*	400 (tr. only)	..	£173,018	*	896,945	5,737,478	*Lighting and traction station	47
4ft. 8½in.	95 & 102	70 d.d. ..	1,950*	650	..	£257,176	*	1,884,137	16,277,418	*Lighting and traction station. Tramways taken over from Company, June, 1906	48
3ft. 6in.	81 & 65	36 d.d. ..	700	..	..	£197,375		884,223	5,326,081	65-lb. rails Falk welded, 81-lb. rails Thermit welded. Data to Dec. 31, 1908	49
3ft. 6in.	90	16 s.d. ..	*	306.8	..	£76,269	*	373,344	2,600,957	*Lighting and traction station. Energy purchased from Corp. Electricity Department. Data to Mar. 31, 1909	50
4ft. 8½in.	100	12 d.d. ..	*	..	..	..	*	317,127	2,055,033	*Energy purchased from Dartford U. D. C. Data to Mar. 25, 1908	51
4ft. 0in.	95½	14 d.d., 3 s.d. regen.	900*	300	92 KW.	£91,000	*	240,000	2,450,000	*Lighting and traction station. Data to Mar. 31, 1909..	52
4ft. 0in.	95	43 d.d., 4 s.d.	1,100*	500	170 KW.	£225,509	£13,000* (tr. only)	961,886	8,775,686	*Lighting and traction station. Energy purchased from Electricity Committee. Data to Mar. 31, 1908	53
3ft. 6in.	92	25 d.d. ..	*	..	..	£162,337	*	590,473	5,410,685	4½ miles leased from Corporation. *Energy purchased from Devonport Corporation. Data to Dec. 31, 1908	54
4ft. 8½in.	100	25 d.d. ..	1,040*	500	..	£86,642	*	479,825	2,866,912	*Lighting and traction station; energy supplied at 1½d. per unit. Data to Mar. 31, 1909	55
3ft. 6in.	90 & 87	21 d.d. ..	209* (tr. only)	..	280 KW.-hours	£62,850	*	314,378	2,472,041	River Light Rly. figures included. *Lighting and traction station. Data to Mar. 31, 1909	56
5ft. 3in.	105	330 d.d., 3 s.d.	4,300*	2,957	..	£1,992,558	..	7,889,576	51,512,995	*A.C. 2,500v. 3ph. to sub-stations, D.C. to line at 500v. Data for 1906-7.	57
3ft. 6in.	50	6 d.d., 1 loco., 18 wagons	240	200	..	£69,254*	..	140,580	403,036	*Including conversion & alteration of gauge. Data to Dec. 31, 1908	58
3ft. 6in.	90	24 d.d., 35 s.d.	500	..	325 KW.	£375,706	..	912,263	7,649,693	Part power supplied by Dudley Corp., also by Midland Corporation for E. P. D. Data to Dec. 31, 1908	59
4ft. 7¾in.	90	6 d.d., 24 comb.	*	41	..	..	*	402,489†	1,842,098†	*Energy purchased from Electric Supply Corporation Ltd. †From Aug. 1, 1908, to Apr. 30, 1909	60
4ft. 8½in.	94 to 100	60 d.d., 6 comb.	*	..	..	£380,088	*	1,281,552	16,367,911	*Lighting and traction station. Data to May 15, 1908 ..	61
4ft. 8½in.	90	14 d.d. ..	420	500	..	..	..	332,000	1,695,340	Data to July 31, 1908	62
4ft. 8½in.	90	40 d.d. ..	1,925* tr. 450	400 (tr. only)	..	£164,064 (1907)	£122,511* (1907)	1,091,586	14,444,290 (1906)	*Lighting and traction station; energy purchased from Electricity Department. Data to Mar. 31, 1908	63
4ft. 8½in.	102	11 d.d. ..	240*	350	165 KW.†	£69,647	*	..	..	*Energy purchased from Eccles Corporation since Sept., 1907. †With Highfield booster	64
4ft. 8½in	100	14 d.d., 2 s.d. regen.	*	..	..	£87,754†	£7,428†	321,332	2,288,491	*Lg. and tr. stn. †Includes cost of traction plant in power station, and cables. Data to Mar. 31, 1908	65
3ft. 6in.	..	14 d.d. ..	*	..	..	£55,000	£9,000†	..	..	*Lighting and traction station. †Tramways proportion	66
4ft. 0in.	90	18 d.d. ..	*	..	..	£98,861	*	411,807	3,186,636	Extensions to Grangemouth and Laurieston, 5.45 miles. *Energy purchased from Scottish Central Elec. Power Co.	67
4ft. 8½in.	98	13 d.d. ..	550*	300	..	£43,696 & £25,000	£42,000*	†	†	*Lighting and traction station. †Included in S. Lancs. Tramways Co.'s returns. Data to Apr. 16, 1909	68
3ft. 6in.	36	2 motor, 1 trailer	*	..	..	..	*	..	..	Third-rail electric railway. *Energy supplied by Felixstowe Corporation	69
4ft. 8½in.	90	25 d.d., 15 s.d. 11 comb.	*	..	..	£318,569	*	1,295,186	12,126,530	*Energy purchased from County of Durham E. P. D. Co., Ltd. Data to Dec. 31, 1908	70
3ft. 0in.	43	3 s.d., 19 tr.	100	90	..	£55,472	..	58,947	128,546	This was the first electric tramway in the United Kingdom	71
4ft. 7¾in.	110	763 d.d. ..	14,200	8,364	..	£2,589,763	£555,810	20,802,797 (May, 1909)	221,744,569 (May, 1909)	6,500v. 3-ph. to sub-stations. Data to May 31, 1908	72
4ft. 8½in.	90	7 d.d., 1 s.d.	425*	150 (tr. only)	600 A.H.	£54,103	£49,247*	306,050	1,501,786	*Lighting and traction station. Data to Dec. 31, 1908	73
3ft. 6in.	90	30 d.d. ..	1,150*	400	..	£143,975 net (est.)	*	557,028	3,347,447	*Lighting and traction station. Energy purchased from Elec. Dept. at 1d. per unit. Data to Mar. 31, 1909	74
4ft. 7¾in.	95	22 d.d. ..	750*	..	..	..	..	484,358	1,996,515	*Tramways Co. supply D.C. from sub-stations to Gosport & Alverstoke Electric Lg. Co. Data to Sept. 30, 1908	75
4ft. 8½in.	87	16 d.d., 2 s.d.	*	..	..	£98,506	*	£306,961	2,779,697	* Energy purchased from Gravesend Corporation. Data to Dec. 31, 1908	76
4ft. 7¾in.	92	40 (1 demi-car)	*	..	..	£233,778	*	658,514	5,857,978	* Energy purchased from Greenock Corporation. Data to Dec. 31, 1908	77
4ft. 8½in.	90	32 d.d. ..	300	..	..	..	..	..	..	Energy purchased from Grimsby Corpn. for lines in Grimsby	78
4ft. 8½in.	40, 74 & 84	9 d.d., 1 s.d. 8 trailers	130	100	..	£27,682	..	171,246	865,259	Refuse destructor takes entire load when refuse available	79
3ft. 6in.	95	93 d.d., 2 s.d.	4,750*	2,850	660 KW.	£395,879	£255,742*	1,815,692	16,110,648	* Lighting and traction station; tramways supplied at 1¼d. per unit. Data to Mar. 31, 1909	80
3ft. 6in.	90	21 d.d. ..	400	360	..	..	..	421,178	2,440,029	Data to Dec. 1908	81
3ft. 6in.	90	65 d.d. ..	2,100	..	..	£488,300		1,400,000	9,000,000	Two rotary-converter sub-stations. *2 route miles on Dolter surface-contact system. Data to Dec. 31, 1908.	82
4ft. 0in.	100	..	*	..	..	..	..	*	..	*At present Accrington is running cars. Haslingden about to purchase energy in bulk and distribute it.	83
3ft. 0in.	60	3 s.d. ..	50	..	..	..	..	..	..	Pier Electric Railway. Third rail, angle bar beneath deck. Gas power. Data to April 20, 1909	84
4ft. 8½in.	90	*	900†	400	..	£28,769	£6,496†	275,272	2,221,147	*Rolling stock supplied by Bury & Rochdale; energy by Heywood. †Lg. and tr. station. Data to Mar. 31, 1909	85
4ft. 7¾in.	98 & 105	70 d.d. ..	2,200	1,720	..	£358,557	£50,769	1,998,185	17,434,794	Data to March 31, 1909	86
4ft. 8½in.	94	116 d.d ..	1,560	1,350	..	£488,234		3,379,116	32,958,883	Data to March 31, 1909	87
4ft. 8½in.	100	22 d.d. (6 bogie cars)	*	..	..	£142,498	*	677,100	6,586,163	*Lighting and traction station. Data to Mar. 31, 1909.	88
3ft. 6in.	90	13 d.d. ..	1,000*	600	..	£46,765	*	198,145	1,968,950	* Energy purchased from Derbyshire and Notts. Electric Power Co. Data to March 31, 1908	89
3ft. 6in.	90	36 d.d. ..	*	..	..	£114,480	*	643,038	4,841,411	* Lighting and traction station. Data to Mar. 31, 1909	90
3ft. 0in.	56 & 62½	37 mr., 44 tr. (s.d. comb.)	1,300	1,250	300 KW.	..	..	380,080 (train miles)	546,666	.. ..	91
3ft. 6in.	36	2 automob.	200	..	..	£41,445	..	34,049	206,994	Open in summer only. Data to October 31, 1908	
4ft. 8½in.	65	8 d.d. ..									
3ft. 6in.	90	60 d.d. ..	1,100*	960	60 KW.	..	*	750,000	4,500,000	* Lighting and traction station. Data to Sept. 30, 1908	92
4ft. 8½in.	95	10 d.d. ..	*	..	..	£68,250	*	183,730	1,065,386	*Energy purchased from County of Durham E.P.D. Co., and South Shields Corp. Data to Dec. 31, 1908	93
4ft. 0in.	95	12 d.d., 2 motor buses	200*	180	..	£45,000	£43,000*	167,015 (9 months)	1,429,597 (9 months)	*Lighting and traction; 200 KW. for traction. Year ends Mar. 31, 1909	94

TRAMWAYS, RAILWAYS AND

UNITED KINGDOM.

	Locality.	Lines Owned by	Year of opening.	Tramways Manager.	Tramways Electrical Engineer.	Miles of Route.	Gauge.	Weight of Rails per yard, lb.	Motor Cars.
95	KIDDERMINSTER AND STOURPORT	Kidderminster & Stourport Electric Tramway Co., Ltd.	1898	A. Charlton (Eng & Man.)	A. Charlton ..	4.6	3ft. 6in.	75	4 d.d., 9 s.d.
96	KILMARNOCK	Kilmarnock Corporation	1904	Alf. H. Burbidge	Alf. H. Burbidge	4.29	4ft. 8½in.	90	14 d.d. ..
97	KIRKCALDY	Kirkcaldy Corporation	1903	O. F. Francis ..	O. F. Francis ..	5.25	3ft. 6in.	87	22 d.d. ..
98	LANCASTER	Lancaster Corporation	1903	W. A. Tester	W. A. Tester ..	4	4ft. 8½in.	90	12 d.d. ..
99	LEAMINGTON & WARWICK	Leamington and Warwick Electrical Co., Ltd.	1905	R. L. McCulloch (Eng. & Man.)	R. L. McCulloch	3.05	3ft. 6in.	..	12 d.d. ..
100	LEEDS	Leeds Corporation	1897	J. B. Hamilton	J. Burbridge ..	53.5	4ft. 8½in.	105 & 111	275 d.d., 1 s.d.
101	LEICESTER	Leicester Corporation	1904	A. F. Lucas ..	T. R. Smith .. (Tram. Eng.)	20	4ft. 8½in.	100	140 d.d. ..
102	LEITH	Leith Corporation	1905	F. A. Fitzpayne (Interim)	A. Peden Rutherford (Cons. Eng.)	6	4ft. 8½in.	106.7	37 d.d. ..
103	LEYTON	Leyton Urban District Council ..	1903	F. Schofield ..	F. Harman Lewis	9.5	4ft. 8½in.	105	60 d.d. ..
104	LLANDUDNO & COLWYN BAY	Llandudno & Colwyn Bay Elec. Railway, Ltd.	1907	W. H. Moorhous.	.. .. ..	6.6	3ft. 6in.	90	14 s.d. ..
105	LINCOLN AND BRACEBRIDGE	Lincoln Corporation	1905	Stanley Clegg ..	Stanley Clegg ..	1.75	4ft. 8½in.	100	8 d.d. ..
106	LIVERPOOL	Liverpool Corporation	1898	C. W. Mallins ..	A.B.Holmes (cons.) A. Clough (res.)	58.5	4ft. 8½in.	95 & 123	513 d.d., 12 s.d.
107	LIVERPOOL—PRESCOT ..	Lancashire Light Railway Co. Ltd.	1902	J. R. Salter ..	J. R. Salter ..	3	4ft. 8½in.	..	7 d.d. ..
108	LONDON (COUNTY)	London County Council	1903	A. L. C. Fell ..	J. H. Rider ..	85.83	4ft. 8½in.	102 & 105	1120d.d.,50s.d.
109	LOWESTOFT	Lowestoft Corporation	1903	G. A. Bruce ..	G. A. Bruce ..	4	3ft. 6in.	100	15 d.d., 4 s.d.
110	LUTON	J. G. White & Co., Ltd.	1908	.. .. ..	W. H. Cooke ..	5.25	4ft. 8½in.	95	12 d.d. ..
111	MAIDSTONE	Maidstone Corporation	1904	F. E. Saunders..	E. E. Hoadley ..	5.25	3ft. 6in.*	96	17 d.d. ..
112	MANCHESTER	Manchester Corporation	1901	J. M. McElroy..	J. J. McMahon..	105.3	4ft. 8½in.	102	521 d.d., 45 comb.
113	MANSFIELD & DISTRICT ..	Mansfield & Dist. Lt. Ry. Co. (controlled by M. & Dist. Tys. Ltd.)	1905	C. R. Walker ..	C. R. Walker ..	10	4ft. 8½in.	90	20 d.d. ..
114	MERTHYR TYDFIL	Merthyr Electric Traction and Lighting Co., Ltd.	1901	L. W. Dixon (Man. & Eng.)	H. King (Traffic Supt.)	2.98	3ft. 6in.	96	3 d.d.,12 s.d.
115	MEXBOROUGH, RAWMARSH & SWINTON	Mexborough & Swinton Tramways Co.	1907	Percy Priestly ..	Percy Priestly ..	7	4ft. 8½in.	90	20 d.d. ..
116	MIDDLESBROUGH, STOCKTON & THORNABY	Imperial Tramways Co.	1898	Sir J. C. Robinson (Man. Dir.)	Sir J.C. Robinson	9	3ft. 6in.	92.5	50 d.d., 10 comb.
117	MIDDLESEX & HERTFORDSHIRE	Metropolitan Electric Tramways Ltd.	1904	J. Devonshire .. (Man. Dir.)	A. H. Pott ..	42	4ft. 8½in.	101	171 d.d., 16 s.d.
118	MIDDLETON, ROCHDALE AND OLDHAM	Middleton Electric Traction Co., Ltd.	1902	W. F. Endean ..	.. .. ..	8.5	4ft. 8½in.	90	5 d.d., 18 s.d., 4 comb.
119	MUSSELBURGH & DISTRICT	Musselburgh and District Electric Light and Traction Co., Ltd.	1904	A. A. Watkins	A. A. Watkins ..	3	4ft. 8½in.	90	14 d.d. ..
120	NELSON	Nelson Corporation	1903	D. Helme ..	D. Helme ..	2.75	4ft. 0in.	107	6 d.d., 3 s.d. comb.
121	NEWCASTLE-ON-TYNE ..	Newcastle-on-Tyne Corporation..	1901	Ernest Hatton ..	Ernest Hatton ..	31.3	4ft. 8½in.	101	77 d.d., 88 s.d., 22 comb.
122	NEWPORT (MON.)	Newport Corporation	1903	H. Collings Bishop	H. Collings Bishop	7.5	4ft. 8½in.	96	40 d.d. ..
123	NORTHAMPTON	Northampton Corporation ..	1904	J. Gottschalk ..	John F. Cameron	5.5	3ft. 6in.	90	22 d.d. ..
124	NORWICH	Norwich Electric Tramways Co...	1900	Alan N. Banister	Alan N. Banister	14.62	3ft. 6in.	65.5	47 d.d. inc. 5 regen.
125	NOTTINGHAM	Nottingham Corporation	1901	J. Aldworth ..	H. Talbot	19	4ft. 8½in.	107	125 d.d. ..
126	OLDHAM	Oldham Corporation	1900	Lewis Slattery ..	S. W. Newington	23	4ft. 8½in.	100	57 d.d., 23 s.d.
127	OLDHAM, ASHTON & HYDE	Oldham, Ashton & Hyde Electric Tramway, Ltd.	1899	M. Rathborne ..	E. T. Todd ..	9.13	4ft. 8½in.	96	12 d.d., 34 s.d.
128	PAISLEY JOHNSTON RENFREW BARRHEAD*	Paisley District Tramways Co. ..	1904	Fred Coutts ..	Fred Coutts .. H.F.Parshall,Cons.	15	4ft. 7½in.	90	50 d.d., 2 s.d.
129	PENGE, SUTTON, WALL'N, MITCHAM, TTC., W.CR'N.	South Metropolitan Electric Tramways and Lighting Co., Ltd.	1906	A. V. Mason (Gen. Man.)	A. V. Mason ..	13.09*	4ft. 8½in.	90	51 d.d. ..
130	PERTH	Perth Corporation	1905	John Lambert ..	John Lambert ..	5.8	3ft. 6in.	90	12 d.d. ..
131	PETERBOROUGH	Peterborough Electric Traction Co., Ltd.	1903	J. R. Groves ..	G. Chivers ..	5.31	3ft. 6in.	94	14 d.d. ..
132	PLYMOUTH	Plymouth Corporation	1899	C. R. Everson ..	E. G. Okell ..	4.1	3ft. 6in.	92	26 .. ..
133	PLYMOUTH, STONEHOUSE AND DEVONPORT	Plymouth, Stonehouse & Devonport Tramways Co.	1901	G. H. Moreton..	John Glenn ..	1.5	3ft. 6in.	84	14 d.d. ..
134	PONTYPRIDD	Pontypridd Urban District Council	1905	J. E. Teasdel ..	J. E. Teasdel ..	5.75	3ft. 6in.	93	14 d.d., 6 s.d.
135	PORTSDOWN, COSHAM, PURBROOK AND HORNDEAN	Provincial Tramways Co... ..	1903	J. Fereday Glenn	J. Fereday Glenn J. Glenn (Cons.)	6	4ft. 7¾in.	96	16 d.d. ..
136	PORTSMOUTH	Portsmouth Corporation	1901	W. R. Spaven ..	V. G. Lironi ..	14.8	4ft. 7¾in.	93	100 d.d. ..
137	POTTERIES	Potteries Electric Traction Co., Ltd.	1899	W. Thom ..	F. J. Chapple ..	31.68	4ft. 0in.	87	110 s.d. ..
138	PRESTON	Preston Corporation	1904	Jos. F. Simpson	Jos. F. Simpson	10	4ft. 8½in.	95	30 d.d. ..
139	RADCLIFFE	Bury Corporation	1905	W. Clough ..	H. Wilkinson ..	..	4ft. 8½in.	100	..
140	RAWTENSTALL & BACUP	Rawtenstall Corporation	1909	C. L. Stewart ..	C. L. Stewart ..	9	4ft. 0in.	100	16 d.d. ..
141	READING	Reading Corporation	1903	Walter Binns ..	Walter Binns ..	7·5	4ft. 0in.	96	336 d.d. (inc. bogie)
142	RHONDDA (URBAN DISTRICT)	Rhondda Tramways Co., Ltd. ..	1908	H. J. Nisbett ..	H. J. Nisbett ..	18.5	3ft. 6in.	96	50 d.d. ..
143	ROCHDALE, LITTLEBOROUGH & HEYWOOD	Rochdale Corporation . ..	1902	J. S. D. Moffet	C. C. Atchison.. (Boro' El. Eng.)	19.58	4ft. 8½in.	103	34 d.d., 25 comb.
144	ROTHERHAM	Rotherham Corporation	1903	Edward Cross ..	Edward Cross ..	11.46	4ft. 8½in.	88.5	30 d.d. ..
145	ROTHESAY	Rothesay Tramways Co., Ltd. ..	1902	A. Robertson ..	H. H. Hill ..	4.81	3ft. 6in.	97	20 .. ..
146	ST. HELENS & DISTRICT..	St. Helens Cor. (leased to New St. Helens & Dist. Tramway Co., Ltd.)	1900	J. R. Salter .. (Man. Dir.)	E. M. Hollingsworth	20	4ft. 8½in.	92	44 d.d. ..
147	SALFORD	Salford Corporation	1901	G. W. Holford ..	V.A.H. McCowen	41	4ft. 8½in.	103	166 d.d., 10 comb.
148	SCARBOROUGH	Scarborough Tramways Co. ..	1904	Walter E. Nicoll	Walter E. Nicoll	4.5	3ft. 6in.	90	22 d.d., inc. 7 regen.
149	SEAFORTH, WATERLOO & CROSBY	Liverpool Overhead Railway Co.	1900	E. J. Neachell ..	E. J. Neachell ..	2.5	4ft. 8½in.	92½	12 d.d., 2 s.d.
150	SHEERNESS & QUEENBOROUGH	Sheerness and District Electric Power and Traction Co., Ltd.	1903	G. L. Kirk ..	G. L. Kirk ..	2.5	3ft. 6in.	94	8 d.d. ..
151	SHEFFIELD	Sheffield Corporation	1899	A. R. Fearnley ..	H. E. Yerbury ..	37.84	4ft. 8½in.	110	210 d.d., 58 s.d. 11 wtr. etc.
152	SHIPLEY	Shipley Urban District Council*	1902	C. J. Spencer ..	S. D. Schofield..	6	4ft. 0in.	98	
153	SMETHWICK	Birmingham and Midland Tramways, Ltd.	1905	R. W. Cramp ..	R. Humphries (try.) S. A. Mahood pr.)	12.10	3ft. 6in.	93 & 102	50 d.d., 8 s.d.
154	SOUTHAMPTON	Southampton Corporation	1900	H. F. Street ..	H. F. Street ..	11	4ft. 8½in.	98	49 d.d. ..

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AND POWER COMPANIES

uge.	Weight of Rails per yard, lb.	Motor Cars.	Power Station. Total Capacity in KW.	Power Station. Max. load in KW.	Power Station. Battery max. discharge.	Capital Outlay on Tramway and Rolling Stock.	Capital Outlay on Power Station.	Annual Electric Car Mileage.	Passengers Carried per Annum.	Remarks.	
6in.	75	4 d.d., 9 s.d.	*	..	..	£60,780	*	183,699	793,217	*Energy purchased from Kidderminster & Dist. Elec. Lighting & Traction Co., Ltd. Data for 1907	95
3½in.	90	14 d.d. ..	755*	283	..	£55,333	*	311,500 (estd.)	2,273,000 (estd.)	*Lighting and traction station. Data to May 15, 1909..	96
6in.	87	22 d.d. ..	1,090*	385	200 KW.	£89,447	*	459,065	4,874,199	*Lighting & traction station. Through running in service with Wemyss Tramways. Data to May 15, 1908	97
3½in.	90	12 d.d. ..	1,250*	700	..	£41,340	£37,600*	158,792	1,301,886	*Lighting and traction station. Data to Mar. 27, 1909	98
6in.	..	12 d.d. ..	630	..	..	..	£106,411	179,344	1,082,491	Data to Dec. 31, 1908	99
3½in.	105 & 111	275 d.d., 1 s.d.	6,150	4,940	..	£1,189,217*	£197,330	7,807,092	76,215,618	*Including purchase of lines. Data to Mar. 31, 1909 ..	100
3½in.	100	140 d.d. ..	2,500	1,600	450 KW.	£683,519	£96,754	3,334,136	27,411,286	Data to Dec. 31, 1908	101
3½in.	106.7	37 d.d. ..	2,232*	320	..	£182,166	..	853,681	7,774,942	*Lighting and traction station. Data to May 15, 1908..	102
3½in.	105	60 d.d. ..	2,703*	1,803	450 KW.	£304,257	£91,000*	1,285,251	12,240,607	*Lighting and traction station. Data to March 31, 1909	103
6in.	90	14 s.d. ..	*	..	..	..	*	185,082	1,060,281	*Energy purchased from Llandudno Corporation. Data to Nov. 30, 1908	104
3½in.	100	8 d.d. ..	928* (tr.only)	185 (tr. only)	..	£44,998	£65,151*	156,190	1,516,658	"G.B." surf. cont. system. *Lg. & tr. station. Energy purchased from Electricity Dept. Data to Mar. 31, '09	105
3½in.	95 & 128	513 d.d., 12 s.d.	35,300*	17,245	..	£1,930,602	£2,050,102* (inc.)	12,244,353	121,927,983	*Lighting and traction stations. Energy purchased from Electric Supply Dept. Data to Dec. 31, 1908	106
3½in.	..	7 d.d. ..	*	..	..	£50,832	*	†	†	*Energy purchased from Prescot lighting and traction station. †Included in S. Lancs. Tramways	107
3½in.	102 & 105	1120d.d.,50s.d.	24,000	17,000	..	£6,805,400 (estd.)	£600,000 (to date)	31,962,784	344,705,937	Data to Mar. 31, 1909	108
6in.	100	15 d.d., 4 s.d.	*	..	..	£79,235	*	370,325	2,645,206	*Lighting and traction station. Data to Sept. 30, 1908	109
3½in.	95	12 d.d. ..	1,150*	..	..	£63,000	*	..	..	*Energy purchased from Luton Corporation	110
3in.*	96	17 d.d. ..	300*	280*	150 KW.	£25,000	£55,000*	160,000	1,186,566	*Lighting and traction station	111
3½in.	102	521 d.d., 45 comb.	*	..	..	£1,887,090	*	17,316,753	155,011,884	*Lighting and traction stations. Data to March, 1909	112
3½in.	90	20 d.d. ..	*	..	..	£106,236	*	471,288	2,940,031	*Energy purchased from Mansfield Corporation. Data to Dec. 31, 1908	113
3in.	93	3 d.d., 12 s.d.	820*	394 tr. only	..	£60,260	£47,028* inc. mains	242,891	1,974,208	*Lighting and traction station. Data for 1907	114
3½in.	90	20 d.d. ..	450	..	..	..	..	..	..	.. ..	115
3in.	92.5	50 d.d., 10 comb.	900	..	..	..	..	..	10,000,000 approx.	.. ..	116
3½in.	101	171 d.d., 16 s.d.	*	..	..	..	*	5,087,204	41,242,404	*Energy purchased from North Metropolitan Electric Power Supply Co. Data to Dec. 31, 1907	117
3½in.	90	5 d.d., 18 s.d., 4 comb.	*	..	..	£159,266	*	453,526	3,129,103	*Energy purchased from Middleton Corporation. Data for 1908	118
3½in.	90	14 d.d. ..	600*	450	..	£68,201	*	270,590	2,234,035	Three motor omnibuses. *Lighting & traction station. Data to Dec., 1908	119
3in.	107	6 d.d., 3 s.d. comb.	1,000*	..	..	..	*	190,044	1,811,100	*Lighting and traction station. Data to March 31, 1909	120
3½in.	101	77 d.d., 88 s.d., 22 comb.	5,150	3,300	1,200 KW.	£967,883	£201,770	4,289,997	44,439,282	Data to March 31, 1909	121
3½in.	96	40 d.d. ..	*	..	..	£190,275	*	798,629	8,174,088	*Lighting and traction station. Data to March 31, 1908	122
3in.	90	22 d.d. ..	520	350	150 KW.	£115,165	£12,957	580,018	5,637,660	Data to Mar. 31, 1909	123
3in.	65.5	47 d.d. inc. 5 regen.	800	500	..	£330,000		1,049,175	7,231,601	Data to June 30, 1908	124
3½in.	107	125 d.d. ..	8,576*	..	100 KW.	£608,602	*	3,333,048	33,813,997	*Lighting & traction station. Data to Mar. 31, 1909 ..	125
3½in.	100	57 d.d., 23 s.d.	2,565*	1,485	..	£440,423	£223,341*	1,978,150	20,082,367	*Lighting and traction station. Data to Mar. 25, 1908..	126
3½in.	96	12 d.d., 34 s.d.	*	..	..	£155,304	*	823,815	6,237,954	*Energy purchased from Ashton Corporation. Data to Dec. 31, 1907	127
3in.	90	50 d.d., 2 s.d.	*	..	..	..	*	1,000,000	11,000,000	*Energy purchased from Paisley Corporation	128
3½in.	90	51 d.d. ..	600 (tr. only)	200 (tr. only)	..	£405,364	£81,437	918,550	6,911,094	Lg. & tr. st. Energy also purch. from C'n. and Beck'm. *Also 2.6 m. thro' tr. Croydon. Data to Dec. 31, 1908	129
3in.	90	12 d.d. ..	*	..	..	£54,913	*	239,690	1,759,101	*Energy purchased from Perth Corporation. Data to May 15, 1908	130
3in.	94	14 d.d. ..	*	..	..	£62,742	*	225,499	1,258,439	*Energy purchased from Peterborough Corporation. Data to Dec. 31, 1907	131
3in.	92	26	700*	..	1,140 KW.-hrs.	£117,000	*	..	..	*Lighting and traction station	132
3in.	84	14 d.d. ..	*	..	..	..	*	..	..	*Energy purchased from Devonport Corporation ..	133
3in.	93	14 d.d., 6 s.d.	900*	555	495 KW.	£106,500	*	242,139	1,919,929	*Lighting and traction. Data to Mar. 31, 1907	134
3½in.	96	16 d.d. ..	200*	..	500 A.	..	..	264,823	737,764	J. B. Glenn, Sec. and Man. Dir. *Diesel oil engines Data to Sept. 30, 1908	135
3½in.	93	100 d.d. ..	2,075	874	..	£582,078*	£51,342	2,361,347	21,735,613	*Including purchase. Data to Mar. 31, 1909	136
3in.	87	110 s.d. ..	2,100	..	..	£530,123		2,278,172	18,339,004	Data for 1908	137
3in.	95	30 d.d. ..	600	450	..	£187,000		924,609	8,529,951	Data to Mar. 31, 1909	138
3in.	100	..	490*	310 tr. only	..	..	*	..	2,649,162	*Lighting and traction. Energy supplied by Radcliffe U.D.C.; tramways worked by Bury Corporation	139
3in.	100	16 d.d. ..	880*	..	56 A. for 10 hours.	..	..	..	..	*Lighting and traction station	140
3in.	96	336 d.d. (inc. bogie)	400	500	..	£190,890	£30,000 (exc. site)	915,481	7,933,512	Data to Mar. 31, 1908	141
3in.	96	50 d.d. ..	990	1,040	..	£250,000	£45,000	1,100,000* 331,889 ('08)	9,000,000* 3,287,489 ('08)	*Estimated; first year incomplete. Lines opened: July (6 m.), Sept. (8½ m.) and Nov. (4 m.), 1908.	142
3in.	103	34 d.d., 25 comb.	2,176*	517 (tr. only)	..	£348,510†	£66,414	1,248,362	10,247,338	*Lg. & tr. st. †Inc. £75,000, purchase of Bury, Rochdale & Oldham Trys. in Rochdale dist Data for 1908	143
3in.	88.5	30 d.d. ..	1653*	560	..	£135,948	£12,958*	665,302	6,689,873	*Lighting and traction station; plant available for both purposes. Data to Mar. 31, 1909	144
3in.	97	20	350	..	350 A.H.	£123,117		222,475	1,049,872	Data for 1908	145
3in.	92	44 d.d. ..	*	..	..	£30,000	*	..	..	*Energy purchased from St. Helens Corporation ..	146
3in.	103	166 d.d., 10 comb.	6,400*	..	1,200 A.H.	£573,870	*	5,486,150	45,771,611	*Lighting and traction station. Data for 1907-8 ..	147
3in.	90	22 d.d., inc. 7 regen.	*	..	..	£99,580	*	221,436	1,424,951	*Energy purchased from Scarborough Electric Supply Co. Data to Dec. 31, 1908	148
3in.	92½	12 d.d., 2 s.d.	160 (substn.)	..	1,800 A.H.	£28,917	*	285,131	2,279,895	*Energy from Liverpool Overhead Ry. power station. Data to Dec. 31, 1908	149
3in.	94	8 d.d. ..	700*	387	..	£83,145 inclusive	*	118,201	811,147	Bow collector. *Lighting and traction station. Data to Dec. 31, 1908	150
3in.	110	210 d.d., 58 s.d. 11 wtr. etc.	5,725	4,500	..	£1,067,775*	£152,784*	7,364,305	76,356,081	*Data to Mar. 25, 1908; other data to Mar. 25, 1909 ..	151
3in.	98	*	1,170†	621	150 KW.	..	£62,763†	*	*	*Leased to Bradford Corporation. †Lighting and traction station	152
3in.	93 & 103	50 d.d., 8 s.d.	3,530*	2,000	..	£351,536	£115,228*	993,824	11,012,280	*Lighting and traction station. Data for 1908	153
3in.	98	49 d.d. ..	1,380*	..	1,500 KW.	£200,678	*	1,157,451	10,121,887	*Lighting and traction station. Data for 1907-8 ..	154

113	MANSFIELD & DISTRICT	Mansfield & Dist. Lt. Ry. Co. (controlled by M. & Dist. Tys. Ltd.)	1905	C. R. Walker	C. R. Walker	10	4ft. 8½in.	90	comb. 20 d.d.
114	MERTHYR TYDFIL	Merthyr Electric Traction and Lighting Co., Ltd.	1901	L. W. Dixon (Man. & Eng.)	H. King (Traffic Supt.)	2.98	3ft. 6in.	93	3 d.d., 12 s.d.
115	MEXBOROUGH, RAWMARSH & SWINTON	Mexborough & Swinton Tramways Co.	1907	Percy Priestly	Percy Priestly	7	4ft. 8½in.	90	20 d.d.
116	MIDDLESBROUGH, STOCKTON & THORNABY	Imperial Tramways Co.	1898	Sir J. C. Robinson (Man. Dir.)	Sir J.C. Robinson	9	3ft. 6in.	92.5	50 d.d., 10 comb.
117	MIDDLESEX & HERTFORDSHIRE	Metropolitan Electric Tramways Ltd.	1904	J. Devonshire (Man. Dir.)	A. H. Pott	42	4ft. 8½in.	101	171 d.d., 16 s.d.
118	MIDDLETON, ROCHDALE AND OLDHAM	Middleton Electric Traction Co., Ltd.	1902	W. F. Endean		8.5	4ft. 8½in.	90	5 d.d., 18 s.d.
119	MUSSELBURGH & DISTRICT	Musselburgh and District Electric Light and Traction Co., Ltd.	1904	A. A. Watkins	A. A. Watkins	3	4ft. 8½in.	90	4 comb. 14 d.d.
120	NELSON	Nelson Corporation	1903	D. Helme	D. Helme	2.75	4ft. 0in.	107	6 d.d., 3 s.d. comb.
121	NEWCASTLE-ON-TYNE	Newcastle-on-Tyne Corporation	1901	Ernest Hatton	Ernest Hatton	31.3	4ft. 8½in.	101	77 d.d., 88 s.d., 22 comb
122	NEWPORT (MON.)	Newport Corporation	1903	H. Collings Bishop	H. Collings Bishop	7.5	4ft. 8½in.	96	40 d.d.
123	NORTHAMPTON	Northampton Corporation	1904	J. Gottschalk	John F. Cameron	5.5	3ft. 6in.	90	22 d.d.
124	NORWICH	Norwich Electric Tramways Co.	1900	Alan N. Banister	Alan N. Banister	14.62	3ft. 6in.	65.5	47 d.d. inc. 5 regen.
125	NOTTINGHAM	Nottingham Corporation	1901	J. Aldworth	H. Talbot	19	4ft. 8½in.	107	125 d.d.
126	OLDHAM	Oldham Corporation	1900	Lewis Slattery	S. W. Newington	23	4ft. 8½in.	100	57 d.d., 23 s.d.
127	OLDHAM, ASHTON & HYDE	Oldham, Ashton & Hyde Electric Tramway, Ltd.	1899	M. Rathborne	E. T. Todd	9.13	4ft. 8½in.	96	12 d.d., 34 s.d.
128	PAISLEY JOHNSTON RENFREW BARRHEAD*	Paisley District Tramways Co.	1904	Fred Coutts	Fred Coutts	15	4ft. 7½in.	90	50 d.d., 2 s.d.
129	PENGE, SUTTON, WALL'N, MITCHAM, TTC., W.CR'N.	South Metropolitan Electric Tramways and Lighting Co., Ltd.	1906	A. V. Mason (Gen. Man.)	H.F.Parshall,Cons. A. V. Mason	13.09*	4ft. 8½in.	90	51 d.d.
130	PERTH	Perth Corporation	1905	John Lambert	John Lambert	5.8	3ft. 6in.	90	12 d.d.
131	PETERBOROUCH	Peterborough Electric Traction Co., Ltd.	1903	J. R. Groves	G. Chivers	5.31	3ft. 6in.	94	14 d.d.
132	PLYMOUTH	Plymouth Corporation	1899	C. R. Everson	E. G. Okell	4.1	3ft. 6in.	92	26
133	PLYMOUTH, STONEHOUSE AND DEVONPORT	Plymouth, Stonehouse & Devonport Tramways Co.	1901	G. H. Moreton	John Glenn	1.5	3ft. 6in.	84	14 d.d.
134	PONTYPRIDD	Pontypridd Urban District Council	1905	J. E. Teasdel	J. E. Teasdel	5.75	3ft. 6in.	93	14 d.d., 6 s.d.
135	PORTSDOWN, COSHAM, PURBROOK AND HORNDEAN	Provincial Tramways Co.	1903	J. Fereday Glenn	J. Fereday Glenn J. Glenn (Cons.)	6	4ft. 7½in.	96	16 d.d.
136	PORTSMOUTH	Portsmouth Corporation	1901	W. R. Spaven	V. G. Lironi	14.8	4ft. 7½in.	93	100 d.d.
137	POTTERIES	Potteries Electric Traction Co., Ltd.	1899	W. Thom	F. J. Chapple	31.68	4ft. 0in.	87	110 s.d.
138	PRESTON	Preston Corporation	1904	Jos. F. Simpson	Jos. F. Simpson	10	4ft. 8½in.	95	30 d.d.
139	RADCLIFFE	Bury Corporation	1905	W. Clough	H. Wilkinson		4ft. 8½in.	100	
140	RAWTENSTALL & BACUP	Rawtenstall Corporation	1909	C. L. Stewart	C. L. Stewart	9	4ft. 0in.	100	16 d.d.
141	READING	Reading Corporation	1903	Walter Binns	Walter Binns	7·5	4ft. 6in.	96	336 d.d. (inc. bogie)
142	RHONDDA (URBAN DISTRICT)	Rhondda Tramways Co., Ltd.	1908	H. J. Nisbett	H. J. Nisbett	18.5	3ft. 6in.	96	50 d.d.
143	ROCHDALE, LITTLEBOROUCH & HEYWOOD	Rochdale Corporation	1902	J. S. D. Moffet	C. C. Atchison (Boro' El. Eng.)	19.58	4ft. 8½in.	103	34 d.d., 25 comb.
144	ROTHERHAM	Rotherham Corporation	1903	Edward Cross	Edward Cross	11.46	4ft. 8½in.	88.5	30 d.d.
145	ROTHESAY	Rothesay Tramways Co., Ltd.	1902	A. Robertson	H. H. Hill	4.81	3ft. 6in.	97	20
146	ST. HELENS & DISTRICT	St. Helens Cor. (leased to New St. Helens & Dist. Tramway Co., Ltd.)	1900	J. R. Salter (Man. Dir.)	E. M. Hollingsworth	20	4ft. 8½in.	92	44 d.d.
147	SALFORD	Salford Corporation	1901	G. W. Holford	V. A. H. McCowen	41	4ft. 8½in.	103	166 d.d., 10 comb.
148	SCARBOROUCH	Scarborough Tramways Co.	1904	Walter E. Nicoll	Walter E. Nicoll	4.5	3ft. 6in.	90	22 d.d., inc. 7 regen.
149	SEAFORTH, WATERLOO & CROSBY	Liverpool Overhead Railway Co.	1900	E. J. Neachell	E. J. Neachell	2.5	4ft. 8½in.	92½	12 d.d., 2 s.d.
150	SHEERNESS & QUEENBOROUCH	Sheerness and District Electric Power and Traction Co., Ltd.	1903	G. L. Kirk	G. L. Kirk	2.5	3ft. 6in.	94	8 d.d.
151	SHEFFIELD	Sheffield Corporation	1899	A. R. Fearnley	H. E. Yerbury	37.84	4ft. 8½in.	110	210 d.d., 58 s.d. 11 wtr. etc.
152	SHIPLEY	Shipley Urban District Council*	1902	C. J. Spencer	S. D. Schofield	6	4ft. 0in.	98	
153	SMETHWICK	Birmingham and Midland Tramways, Ltd.	1905	R. W. Cramp	R. Humphries (try.) S. A. Mahood pr.)	12.10	3ft. 6in.	93 & 102	50 d.d., 8 s.d.
154	SOUTHAMPTON	Southampton Corporation	1900	H. F. Street	H. F. Street	11	4ft. 8½in.	98	49 d.d.
155	SOUTHEND-ON-SEA	Southend Corporation	1901	Robert Birkett	Robert Birkett	7.5	3ft. 6in.	90	25 d.d.
156	SOUTH LANCASHIRE	South Lancashire Tramways Co.	1902	J. R. Salter	J. R. Salter	39	4ft. 8½in.	90	82 d.d., 1 s.d.
157	SOUTHPORT	Southport Corp. (part leased to Southport & Birkdale Tram. Co.)	1900	T. J. Kendrew	A. S. Black (Boro' Elec. Eng.)	Cor. 8.5 Co. 5.2	4ft. 8½in.	87, 90, & 101	17 d.d., 1 s.d. 8 comb.
158	SOUTHPORT & BIRKDALE	Southport Tramways Co., Ltd.	1901	J. Lloyd	H. Bentham	8.17	4ft. 8½in.	87	20 d.d. (1 regen.) 1s.d.(demi-car)
159	SOUTHPORT PIER	Southport Pier Co., Ltd.	1905	W. H. Scott Pier & Tram. Man.		0.6	3ft. 6in.		3 s.d.
160	SOUTH SHIELDS	South Shields Corporation	1906	Lionel E. Harvey	J. H. Cawthra	10.25	4ft. 8½in.	95	35 d.d.
161	SOUTH STAFFORDSHIRE*	South Staffs. Tramways Lessee Co.	1902	R. W. Cramp (Gen. Man.)		18.97	3ft. 6in.	90 & 96	30 d.d.
162	STALYBRIDGE, HYDE, MOSSLEY, DUKINFIELD	Stalybridge, Hyde, Mossley and Dukinfield Tr. & Elec. Board	1904	Frank Schofield	R. Blackmore	21	4ft. 8½in.	99	40 d.d., 10 s.d. 10 comb.
163	STOCKPORT & DISTRICT	Stockport Corporation	1901	A. T. Eardley	R. Lomax	15.5	4ft. 8½in.	105 & 99	50 d.d.
164	SUNDERLAND	Sunderland Corporation	1900	A. R. Dayson	A. R. Dayson		4ft. 8½in.	96	58 d.d., 8 s.d. 4 comb.
165	SUNDERLAND DISTRICT	Sunderland District Electric Tramways, Ltd.	1905	G. Stratton	G. Stratton	14.5	4ft. 8½in.	90	38 d.d.
166	SUTTON AND HOWTH	Great Northern Ry. Co. (Ireland)	1901	H. Plews (Gen. Man. G.N.R.I.)	A. W. Whieldon	5.37	5ft. 3in.	72	10 d.d., 1 s.d.
167	SWANSEA	Swansea Improvements & Tramway Co.	1900	D. James	A. Johnston	12.43*	4ft. 8½in.	87 & 95	28 d.d., 30 s.d. 12 comb.
168	SWINDON	Swindon Corporation	1904	T. Medcalf	A. Dimmack	3.7	3ft. 6in.	105	12 d.d.
169	TAUNTON	Taunton Electric Traction Co., Ltd.	1901	F. J. Ayliffe		1.25	3ft. 6in.	90	6 s.d.
170	TORQUAY	National Electric Construction Co., Ltd.	1907	Harry Holiday		7	3ft. 6in.	90	18 d.d.
171	TYNEMOUTH & DISTRICT	Tynemouth and District Electric Traction Co., Ltd.	1901	R. Simpson		4.21	3ft. 6in.	90	21 d.d.
172	TYNESIDE	Tyneside Tramways & Tramroads Co.	1902	J. C. Little (Sec. & Res. Man.)	F. H. Briggs	11	4ft. 8½in.	95	24 d.d.
173	WAKEFIELD & DISTRICT	Wakefield & District Light Railway Co.	1904	H. England	C. E. Davies	24.69	4ft. 8½in.	96	67 d.d.
174	WALLASEY	Wallasey Urban District Council	1902	R. R. Greene	J. A. Crowther	8.5	4ft. 8½in.	98	40 d.d.
175	WALSALL	Walsall Corporation	1904	R. L. Horsfield	A. S. Barnard	13.5	3ft. 6in.	90 & 92	32 d.d.
176	WALTHAMSTOW	Walthamstow Urban District Council	1905	Wm. Murray	G. R. Spurr	9	4ft. 8½in.	100	32 d.d.
177	WALTON-ON-THE-NAZE PIER	Coast Development Corporation, Ltd.	1898	H. A. Wightman	E. A. Lambert	0.5	3ft. 6in.	96	1 motor car, 2 trailers
178	WARRINGTON	Warrington Corporation	1902	J. Telfer	F. V. L. Mathias	6.5	4ft. 8½in.	90	21 d.d.
179	WEMYSS & DISTRICT	Wemyss and District Tramways Co., Ltd.	1906	Major W. T. J. Marshall	R. Richardson	7.5	3ft. 6in.	95 & 97	17 s.d.
180	WEST BROMWICH	South Staffordshire (Lessee Co.)	1902	R. W. Cramp	W. A. Jackson	7	3ft. 6in.	97½	30 d.d.
181	WEST HAM	West Ham Corporation	1904	H. E. Blain		15	4ft. 8½in.	100	100 d.d., 2 water cars
182	WEST MIDDLESEX, THAMES VALLEY & WIMBLEDON	London United Tramways, Ltd.	1901	Sir J. C. Robinson (Man. Dir. & Eng.)	C. R. Holmes	55.5	4ft. 8½in.	92½ & 100	340 d.d.
183	WESTON-SUPER-MARE	Weston-super-Mare and District Electric Supply Co., Ltd.	1902	G. Charlton	G. Charlton	3	4ft. 8½in.	90	8 d.d., 4 s.d.
184	WIGAN	Wigan Corporation	1901	James Slevin	James Slevin	24.87	3ft. 6in. & 4ft. 8½in.	105	18 d.d., 54 s.d.
185	WOLVERHAMPTON	Wolverhampton Corporation	1902	W. A. Luntley (Gen. Man.)	C. E. C. Shawfield	12	3ft. 6in.	100	31 d.d., 18 s.d. 3 motor buses
186	WOLVERHAMPTON DISTRICT	Wolverhampton District Electric Tramways, Ltd.	1900	R. W. Cramp (Gen. Man.)		14.69	3ft. 6in.	94	32 d.d.
187	WORCESTER	Worcester Electric Traction Co.	1904	R. R. Fairbairn		5.86	3ft. 6in.	94	15 d.d.
188	WREXHAM	Wrexham and District Electric Tramways, Ltd.	1906	A. A. Hawkins		4.38	3ft. 6in.	97	10 d.d.
189	YARMOUTH	Yarmouth Corporation	1902	F. L. Turner	G. Bryant	10.5	3ft. 6in.	90	35 d.d.
190	YORKSHIRE (WOOLLEN DISTRICT)	Yorkshire (W. D.) Electric Tramways, Ltd.	1903	E. A. Paris (Man. Dir.)	R. C. Goldston	22.37	4ft. 8½in.	94	50 d.d., 18 s.d. (inc. 14 regen.)

t. 8¾in.	90	comm. 20 d.d. ..	"	..	..	£106,236	*	471,288	2,940,031	*Energy purchased from Mansfield Corporation. Data to Dec. 31, 1908	113
t. 6in.	93	3 d.d., 12 s.d.	820*	394 tr. only	..	£60,260	£47,026* inc. mains	242,891	1,974,208	*Lighting and traction station. Data for 1907	114
t. 8½in.	90	20 d.d. ..	450	..	..	..	..	..	..	.. ..	115
t. 6in.	92.5	50 d.d., 10 comb.	900	..	..	..	..	..	10,000,000 approx.	.. ..	116
t. 8½in.	101	171 d.d., 16 s.d.	*	..	..	..	*	5,037,204	41,242,404	*Energy purchased from North Metropolitan Electric Power Supply Co. Data to Dec. 31, 1907	117
t. 8½in.	90	5 d.d., 18 s.d., 4 comb.	*	..	..	£159,266	*	453,526	3,129,103	*Energy purchased from Middleton Corporation. Data for 1908	118
t. 8½in.	90	14 d.d. ..	600*	450	..	£68,201	*	270,590	2,234,035	Three motor omnibuses. *Lighting & traction station. Data to Dec., 1908	119
t. 6in.	107	6 d.d., 3 s.d. comb.	1,000*	..	..	..	*	190,044	1,811,100	*Lighting and traction station. Data to March 31, 1909	120
t. 8½in.	101	77 d.d., 88 s.d., 22 comb.	5,150	3,300	1,200 KW.	£967,833	£201,770	4,289,997	44,439,282	Data to March 31, 1909	121
t. 8½in.	96	40 d.d. ..	"	..	..	£190,275	*	798,029	8,174,038	*Lighting and traction station. Data to March 31, 1908	122
t. 6in.	90	22 d.d. ..	520	350	150 KW.	£115,165	£12,957	580,018	5,637,660	Data to Mar. 31, 1909	123
t. 6in.	65.5	47 d.d. inc. 5 regen.	800	500	..	£330,000		1,049,175	7,261,601	Data to June 30, 1903	124
t. 8½in.	107	125 d.d. ..	8,576*	..	100 KW.	£608,602	*	3,333,048	33,813,997	*Lighting & traction station. Data to Mar. 31, 1909 ..	125
t. 8½in.	100	57 d.d., 23 s.d.	2,565*	1,485	..	£440,423	£223,341*	1,978,150	20,082,367	*Lighting and traction station. Data to Mar. 25, 1908..	126
t. 8½in.	96	12 d.d., 34 s.d.	*	..	..	£155,304	*	823,815	6,237,954	*Energy purchased from Ashton Corporation. Data to Dec. 31, 1907	127
t. 7½in.	90	50 d.d., 2 s.d.	*	..	..	..	*	1,000,000	11,000,000	*Energy purchased from Paisley Corporation	128
t. 8½in.	90	51 d.d. ..	600 (tr. only)	200 (tr. only)	..	£405,364	£81,437	918,550	6,911,094	Lg. & tr. st. Energy also purch. from C'n. and Beck'm. *Also 2.6 m. thro' tr. Croydon. Data to Dec. 31, 1908	129
t. 6in.	90	12 d.d. ..	*	..	..	£54,913	*	289,690	1,759,101	*Energy purchased from Perth Corporation. Data to May 15, 1908	130
t. 6in.	94	14 d.d. ..	*	..	..	£62,742	*	225,499	1,258,439	*Energy purchased from Peterborough Corporation. Data to Dec. 31, 1907	131
t. 6in.	92	26	700*	..	1,140 KW.-hrs.	£117,000	*	..	..	*Lighting and traction station	132
t. 6in.	84	14 d.d. ..	"	..	..	..	*	..	..	*Energy purchased from Devonport Corporation ..	133
t. 6in.	93	14 d.d., 6 s.d.	900*	555	495 KW.	£106,500	*	242,139	1,919,929	*Lighting and traction. Data to Mar. 31, 1907	134
t. 7½in.	96	16 d.d. ..	200*	..	500 A.	..	..	264,823	737,764	J. B. Glenn, Sec. and Man. Dir. *Diesel oil engines Data to Sept. 30, 1908	135
t. 7½in.	93	100 d.d. ..	2,075	874	..	£582,078*	£51,342	2,361,347	21,735,613	*Including purchase. Data to Mar. 31, 1909	136
t. 6in.	87	110 s.d. ..	2,100	..	..	£530,123		2,278,172	18,339,004	Data for 1908	137
t. 8½in.	95	30 d.d. ..	600	450	..	£187,000		924,609	8,529,951	Data to Mar. 31, 1909	138
t. 8½in.	103	..	490*	310 tr. only	..	..	*	..	2,649,162	*Lighting and traction. Energy supplied by Radcliffe U.D.C.; tramways worked by Bury Corporation	139
t. 6in.	100	16 d.d. ..	830*	..	56 A. for 10 hours.	..	..	..	..	*Lighting and traction station	140
t. 6in.	96	336 d.d. (inc. bogie)	400	500	..	£190,890	£30,000 (exc. site)	915,481	7,933,512	Data to Mar. 31, 1908	141
t. 6in.	96	50 d.d. ..	990	1,040	..	£250,000	£45,000	1,100,000* 361,889 ('08)	9,000,000* 3,287,489 '08	*Estimated; first year incomplete. Lines opened: July (6 m.), Sept. (8½ m.) and Nov. (4 m.), 1908.	142
t. 8½in.	103	34 d.d., 25 comb.	2,176*	517 (tr. only)	..	£348,510†	£63,414	1,248,362	10,247,338	*Lg. & tr. st. †Inc. £75,000, purchase of Bury, Rochdale & Oldham Trys. in Rochdale dist Data for 1908	143
t. 8½in.	88.5	30 d.d. ..	1653*	560	..	£135,948	£12,958*	665,302	6,689,873	*Lighting and traction station; plant available for both purposes. Data to Mar. 31, 1909	144
t. 6in.	97	20	350	..	350 A.H.	£123,117		222,475	1,049,872	Data for 1908	145
t. 8½in.	92	44 d.d. ..	*	..	..	£30,000	*	..	..	*Energy purchased from St. Helens Corporation ..	146
t. 8½in.	103	166 d.d., 10 comb.	6,400*	..	1,200 A.H.	£573,870	*	5,486,150	45,771,611	*Lighting and traction station. Data for 1907-8 ..	147
t. 6in.	90	22 d.d., inc. 7 regen.	*	..	..	£99,580	*	221,486	1,424,961	*Energy purchased from Scarborough Electric Supply Co. Data to Dec. 31, 1908	148
t. 8½in.	92½	12 d.d., 2 s.d.	160 (substn.)	..	1,830 A.H.	£28,917	*	285,131	2,279,895	*Energy from Liverpool Overhead Ry. power station. Data to Dec. 31, 1908	149
t. 6in.	94	8 d.d. ..	700*	337	..	£83,145 inclusive	*	118,201	811,147	Bow collector. *Lighting and traction station. Data to Dec. 31, 1908	150
t. 8½in.	110	210 d.d., 58 s.d. 11 wtr. etc.	5,725	4,500	..	£1,067,775*	£152,784*	7,364,305	76,356,031	*Data to Mar. 25, 1908; other data to Mar. 25, 1909 ..	151
t. 10in.	98	*	1,170†	621	150 KW.	..	£62,763†	*	*	*Leased to Bradford Corporation. †Lighting and traction station	152
t. 6in.	93 & 102	50 d.d., 8 s.d.	3,530*	2,000	..	£351,586	£115,228*	993,824	11,012,280	*Lighting and traction station. Data for 1908	153
t. 8½in.	98	49 d.d. ..	1,380*	..	1,500 KW.	£200,678	*	1,157,451	10,121,887	*Lighting and traction station. Data for 1907-8 ..	154
t. 6in.	90	25 d.d. ..	*	432	..	£84,653	*	445,570	4,975,907	*Lighting and traction station. Traffic superintendent J. Daniels. Data to Mar. 31, 1909	155
t. 8½in.	90	82 d.d., 1 s.d.	2,750*	1,500	..	£503,000	£30,000*	2,244,344	13,264,575	*Lighting and traction station. Data to Dec. 31, 1908..	156
t. 8½in.	87, 90, & 101	17 d.d., 1 s.d. 8 comb.	2,350*	1,435	600 KW.	£118,483	*	454,734	4,150,081	*Lighting and traction station. Data to Mar. 31, 1908	157
t. 8½in.	87	20 d.d. (1 regen.) 1s.d. (demi-car)	*	..	..	£83,745	*	398,076	2,449,084	*Energy purchased from Southport Corp. and Birkdale Dist. Elec Supply Co., Ltd. Data to Dec. 31, 1908	158
t. 6in.	..	3 s.d. ..	*	..	..	..	*	..	..	Third-rail system. *Energy supplied by Southport Corporation	159
t. 8½in.	95	85 d.d. ..	1,100 tr*	..	..	£169,390	*	812,076	7,147,639	*Lighting and traction station. Data to Mar. 31, 1909	160
t. 6in.	90 & 96	30 d.d. ..	..	..	..	£166,497	..	1,087,974	8,859,415	*W. Bromwich, Wednesbury, Dudley, Tipton, Handsworth, Darlaston. †Energy purchd. Data to 31.12.'08.	161
t. 8½in.	99	40 d.d., 10 s.d. 10 comb.	5,500*	..	750 A.H.	£278,886	£227,557*	1,248,835	10,241,544	*Lighting and traction station. Data to Mar. 31, 1909	162
t. 8½in.	105 & 99	50 d.d. ..	1,600*	900	..	£191,336	£39,099*	..	..	*Lighting & traction station. Energy supplied at 1½d. per unit. Data for 1907-8	163
t. 8½in.	96	58 d.d., 8 s.d. 4 comb.	*	..	..	£289,000	*	1,474,990	14,857,779	*Energy purchased from Corporation Electricity Department. Data to Mar. 31, 1909	164
t. 8½in.	90	33 d.d. ..	*	..	..	..	*	694,386	3,930,868	*Energy purchased from Durham Collieries Electric Power Co. Data to Oct. 28, 1908	165
t. 3in.	72	10 d.d., 1 s.d.	475	470	150 KW.	..	..	85,000	236,208	Feeder for steam line from Dublin to Howth. W. H. Mills, Chief Engineer. Data for 1908	166
t. 8½in.	87 & 95	23 d.d., 30 s.d. 12 comb.	640	420	..	£264,476 inc. purch.	..	1,032,148	8,652,647	*7 miles leased, and part of energy purchased, from Swansea Corporation. Data to Dec. 31, 1907	167
t. 6in.	105	12 d.d. ..	900*	200 tr. only	..	£43,460	*	225,000	2,675,221	*Lighting and traction station	168
t. 6in.	90	6 s.d. ..	*	..	..	£27,418	*	99,381	513,381	*Energy purchased from Taunton Corporation. Data to Dec. 31, 1908	169
t. 6in.	90	18 d.d. ..	*	..	..	..	*	†	†	Dolter surf. cont. system. *Energy purchased from Torquay Corp. †Complete year's figures not yet available	170
t. 6in.	90	21 d.d. ..	*	..	..	£97,918	*	262,712	1,919,119	*Energy purchased from Corporation of Tynemouth Data to Dec. 31, 1908	171
t. 8½in.	95	24 d.d. ..	*	..	..	£207,624	*	675,894	4,143,625	*Energy supplied by Newcastle-upon-Tyne Elec. Supply Co., Ltd., & Tynemouth Corp. Data to Dec 31, 1908	172
t. 8½in.	98	67 d.d. ..	1,603	1,481	..	..	..	1,414,767	6,169,148	.. ..	173
t. 8½in.	98	40 d.d. ..	1,100*	650	..	£138,916	£93,561*	891,540	8,881,088	*Lighting and traction station. Data to Mar. 31, 1908	174
t. 6in.	90 & 92	32 d.d. ..	1,730*	980	..	£181,753	£17,000*	646,515	4,968,162	*Lighting and traction station. Energy purchased from Wallasey Corpor. Elec. Dept. Data to Dec. 31, 1908	175
t. 8½in.	100	32 d.d. ..	*	..	..	£180,000	*	896,737	9,912,348	*Lighting and traction station; gas power. Data to Mar. 31, 1909	176
t. 6in.	96	1 motor car, 2 trailers	..	..	..	..	..	..	..	Third rail pier electric railway. Energy purchased from Walton Elec. Supply Co.	177
t. 8½in.	90	21 d.d. ..	2,150*	1,301	880 A.H.	£101,615	£91,000*	438,519	5,019,344	*Lighting and traction station. Data to Mar. 31, 1908..	178
t. 6in.	95 & 97	17 s.d. ..	*	..	..	£70,884	*	352,369	1,834,898	*Energy purchased from Wemyss Coal Co., Ltd. Data to Dec. 31, 1908	179
t. 6in.	97½	30 d.d. ..	1,550*	795 (tr. only)	150 KW.	£147,758	£65,315*	†	†	*Lighting and traction station. †See South Staffordshire Tramways	180
t. 8½in.	100	100 d.d., 2 water cars	11,400*	1,505	..	£514,062	£336,378†	2,850,000	34,500,000	*Lighting and traction station; energy supplied at 0.95d. per unit. †Inc. lig. plant. Data to Mar. 31, 1909	181
t. 8½in.	92½ & 100	340 d.d. ..	3,500	..	..	..	..	8,614,982*	59,255,919	6 converter sub-stns.; 4 fed from L.U.T. stn., 2 from Lot's Rd. *Also 137,770 horse tr. Data to Dec. 31, 1908	182
t. 8½in.	90	8 d.d., 4 s.d.	800*	369	576 A.	£107,726 inclusive	*	138,009	1,082,013	*Lighting and traction station. Data to Dec., 1907 ..	183
t. 6in.	105	18 d.d., 54 s.d.	1,140*	..	750 A.H.	£515,926	*	1,404,629	11,867,950	*Lighting and traction station. Data for 1907-8 ..	184
t. 8½in.	100	31 d.d., 18 s.d. 3 motor buses	2,080*	..	750 A.H.	£245,861	*	966,139	9,276,023	*Lighting and traction station. Lorain surface-contact system	185
t. 6in.	94	33 d.d. ..	*	..	..	£265,282	*	635,447	4,283,883	*Energy purchased from Dudley Corp. and Midland Elec. Corp. for Pr. Distribution. Data to Dec. 31, 1908	186
t. 6in.	94	15 d.d. ..	*	..	..	£115,969	*	318,927	2,845,490	*Energy purchased from Worcester Corporation. Data for 1907	187
t. 6in.	97	10 d.d. ..	*	..	..	£57,271	*	143,980	935,085	*Energy purchased from Wrexham Corporation. Data to Dec. 31, 1908	188
t. 6in.	90	35 d.d. ..	400*	..	200 KW.-hours	..	*	667,086	4,567,788	*Lighting and traction station	189
t. 8½in.	94	50 d.d., 18 s.d. (inc. 14 regen.)	*	..	..	£328,496 inclusive	*	1,207,041	8,796,613	Lines in Dewsbury, Batley, Cleckheaton, Gomersal Heckmondwike, Ravensthorpe, Thornhill, etc. *Energy purchased from local authorities. Data to Dec. 31, 1908	190

	Name of Railway.	Districts Served.	Year of Opening.	Manager
1	BAKER ST. & WATERLOO RAILWAY	London: Elephant & Castle and Waterloo to Baker Street and Great Central Railway and Edgware Road	1906	A. H. Stanley
2	CENTRAL LONDON RAILWAY	London: Shepherd's Bush to Bank	1900	G. C. Cuninghar (Gen.
3	CHARING CROSS, EUSTON AND HAMPSTEAD RAILWAY	London: Charing Cross to Golder's Green, Hampstead; branch line from Camden Town to Highgate	1907	A. H. Stanley
4	CITY & SOUTH LONDON ELECTRIC RAILWAY	London: Euston & King's Cross to City and Clapham Common	1890	T. C. Jenkin
5	GREAT NORTHERN & CITY ELECTRIC RAILWAY	London: Finsbury Park to City	1904	R. P. Brousson
6	GREAT NORTHERN, PICCADILLY & BROMPTON RAILWAY	London: Finsbury Park to Hammersmith	1906	A. H. Stanley
7	HAMMERSMITH & CITY RAILWAY	London: Hammersmith & Addison Rd. to City	1906	J. C. Inglis
8	LANCASHIRE & YORKSHIRE RAILWAY	Liverpool, Southport & Crossens; Liverpool & Aintree	1904 (converted)	John A. F. Aspi (Gen.
9	LIVERPOOL OVERHEAD RAILWAY	Liverpool Docks	1893	E. J. Neachell.
10	LONDON, BRIGHTON & SOUTH COAST RAILWAY	London: Victoria to London Bridge *via* Brixton	Under conversion	William Forbes Man.)
11	MERSEY TUNNEL ELECTRIC RAILWAY	Birkenhead & Liverpool	1903 (converted)	J. Shaw (Gen.
12	METROPOLITAN DISTRICT RAILWAY	London: Wimbledon, Hounslow, Ealing, South Harrow & Richmond to Charing Cross, City, East Ham, Barking, etc.	1905 (converted)	A. H. Stanley
13	METROPOLITAN RAILWAY	London: Baker Street to Uxbridge, & Inner Circle	1905 (converted)	R. H. Selbie Man.)
14	MIDLAND RAILWAY	Lancaster, Morecambe and Heysham Harbour	1908 (converted)	W. G. Grane Man.)
15	NORTH-EASTERN RAILWAY	Newcastle & Tyneside	1904 (converted)	A. Kaye Butterw (Gen
16	WATERLOO & CITY ELECTRIC RAILWAY	London: Waterloo Station & City (Mansion House)	1898	Sir C. J. Owen Man.)

	Name of Power Company.	Districts Served.	
1	CLEVELAND & DURHAM COUNTY ELECTRIC POWER CO.	North Riding of Yorkshire and part of Durham County (820 sq. miles)	Grangetow
2	CLYDE VALLEY ELECTRIC POWER CO.	Parts of Lanark, Renfrew, Dumbarton and Stirling (750 sq. miles)	Yoker and
3	CORNWALL ELECTRIC POWER CO.	County of Cornwall	(St. Blazey
4	COUNTY OF DURHAM ELECTRIC POWER SUPPLY CO.	County of Durham (250 sq. miles)	Supplied Electric
5	DERBYSHIRE & NOTTINGHAMSHIRE ELECTRIC POWER CO.	County of Nottingham and part of the County of Derby (1,570 sq. miles)	Ilkeston proposed
6	DURHAM COLLIERIES ELECTRIC POWER SUPPLY CO.	Durham Colliery District*	Philadelph
7	FIFE ELECTRIC POWER CO.	County of Fife	Townhill
8	GLOUCESTERSHIRE ELECTRIC POWER CO.	County of Gloucester	Stroud and
9	KENT ELECTRIC POWER CO.	County of Kent, except Isle of Thanet	Frindsbury proposed
10	LANCASHIRE ELECTRIC POWER CO.	Lancashire south of the Ribble, excluding Manchester, Salford, Stockport, part of Bolton, Liverpool and Bootle	Radcliffe
11	LEICESTERSHIRE & WARWICKSHIRE ELECTRIC POWER CO.	Counties of Leicester and Warwick (1,340 sq. miles)	(Newbold-o field and
12	MIDLAND ELECTRIC CORPORATION FOR POWER DISTRIBUTION, LTD.	Amblecote, Brettell Lane, Brierley Hill, Bilston, Bradley, Compton, Cradley Heath, Darlaston, Deepfields, Finchfield, Heath Town, Kingswinford, Lye, Lower Gornal, Old Hill, Ocker Hill, Penn, Princes End, Pensnett, Quarry Bank, Short Heath, Tipton, Tettenhall, Willenhall, Wednesfield, Wordsley, Wednesbury.	Ocker Hill,
13	NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.	Part of Northumberland (370 sq. miles)	Carville and
14	NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.	Counties of Middlesex, Hertford & Essex (326 sq. miles); also London (Stoke Newington)	Brimsdown Willesden Hertford St. Albans
15	NORTH WALES POWER & TRACTION CO., LTD.	Supplies slate quarries in the neighbourhood of Carnarvon, Blaenau Festiniog, &c.	Cwm-Dyli.
16	NORTH-WESTERN ELECTRICITY & POWER GAS CO.	Parts of Stafford, Derby, Flint and Denbigh	(Stone, Sutt
17	SCOTTISH CENTRAL ELECTRIC POWER CO.	Linlithgow, Clackmannan, parts of Stirling and Dumbarton (400 sq. miles)	Bonnybridg
18	SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.	Glamorganshire and part of Monmouth (1,034 sq. miles)	Treforest ar
19	YORKSHIRE ELECTRIC POWER CO.	Yorkshire (West Riding) 1,800 sq. miles	Thornhill

WESTERN ELECTRIC
COMPANY

ELECTRIC

Year of Opening.	Manager.	Electrical Engineer.	Consulting Engineers.	Length of Route in Miles.	Average distance between Stations, miles.	Average Schedule Speed, miles per hour.	Weight of Rails per Yard.		No. of Motor Cars.	No. of Trailers.	Power Station Capacity Kilowatts
							Running.	Conductor.			
1906	A. H. Stanley	.. ..	.. ..	4.69	0.47	..	90 lb.	85 lb.	36	72	44,000
1900	G. C. Cuningham .. (Gen. Man.)	E. P. Grove (Mech. and Elec. Eng.)	Basil Mott, H. F. Parshall	6.3	0.5	15.5	100 lb.	85 lb.	64	172	5,100
1907	A. H. Stanley	.. ..	.. ..	8.058	0.54	..	90 lb.	85 lb.	60	90	44,000
1890	T. C. Jenkin	P. V. McMahon ..	Basil Mott & David Hay	7.33	0.523	14.3	60 lb. & 80 lb.	40 lb.	52 locos.	165 coaches	3,850
1904	R. P. Brousson ..	R. P. Brousson ..	Sir Douglas Fox & Partners	3.42	0.684	15.7	85 lb.	80 lb.	32	44	3,440
1903	A. H. Stanley	.. ..	.. ..	9.495	0.45	..	90 lb.	85 lb.	72	146	44,000
1906	J. C. Inglis	Roger T. Smith (G.W.R.)	Kennedy & Jenkin ..	4.71	..	..	97½ lb.	102 lb.	..	..	4,000
1904 (converted)	John A. F. Aspinall .. (Gen. Man.)	Geo. Hughes (Chief. Mech. Eng.)	.. ..	70 single track	1.32	30	86 lb.	70 lb.	50 4-motor, 12 2-motor	52	9,750
1898	E. J. Neachell	E. J. Neachell	.. ..	6.5	0.4	..	60 lb.	..	44	7	2,300
Under conversion	William Forbes (Gen. Man.)	.. ..	Philip Dawson	9	..	..	..	Overhead	8 trains	..	*
1903 (converted)	J. Shaw (Gen. Man.)	J. Shaw (Resident) ..	.. ..	4.33	0.72	..	86 lb.	..	24	37	4,000
1905 (converted)	A. H. Stanley	.. ..	.. ..	24.3*	0.65 mile	17.05	87 lb.	100 lb.	161	198	44,000†
1905 (converted)	R. H. Selbie (Gen. Man.)	Charles Jones	.. ..	26	0.71	22	86 lb.	100 lb.	110, and 20 locos.	212	19,000
1908 (converted)	W. G. Granet (Gen. Man.)	W. B. Worthington (Chief Engineer) R. M. Deeley (Loco.)	.. ..	10	3.75	30 and 21.5*	85 lb.	Overhead	3	6	68
1904 (converted)	A. Kaye Butterworth (Gen. Man.)	W. Worsdell (R. S.), C. A. Harrison (P.W.)	Merz and McLellan ..	29.5*	1.14	20.5	90 lb.	80 lb.	65	54	†
1898	Sir C. J. Owens (Gen. Man.)	Herbert Jones	.. ..	1.5	1.5	18	87 lb.	46 lb.	17	12	1,20

ELECTRIC POW

	Generating Stations.	Year of Opening.	Engineer and Manager.	Consulting Engineers.	Power Station capacity, Kilowatts.	Maximum load recorded, Kilowatts.	S
(820 sq. miles) ..	Grangetown*	1904	A. B. Gridley (Man.) ..	Charles H. Merz and William McLellan	6,500	7,550	11,500 v., 40~, 3-
50 sq. miles) ..	Yoker and Motherwell	1905	David A. Starr	Strain & Robertson ..	8,000	4,700	11,000 v., 25~, 3-
.. .. ..	(St. Blazey and Phillack, proposed)	..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..
.. .. ..	Supplied in bulk by Newcastle-upon-Tyne Electric Supply Co.	1902	A. S. Esslemont (Man.) ..	Charles H. Merz and William McLellan.	.. .. ..	.. .. ..	5,750 v., 40~, 3-p
(1,570 sq. miles)..	Ilkeston (Newark and Sutton-in-Ashfield, proposed)	1903	A. E. Loos (Gen. Man.)..	.. ..	1,500	624	11,000 v., 25~, 3-
.. .. ..	Philadelphia	1906	†See "Remarks" ..	†See "Remarks" ..	11,000	4,927	5,750 v., 40~, 3-p
.. .. ..	Townhill	1905	J. S. Thomson (Gen. Man.)	.. ..	600	.. .. ..	3,000 v., 50~, 2-p
.. .. ..	Stroud and West Dean	..	.. ..	G. L. Addenbrooke ..	.. .. ..	.. .. ..	.. .. ..
.. .. ..	Frindsbury (Strood, Blean, Dover & Tonbridge, proposed)	1907	B. H. Harvey (Man.) ..	G. L. Addenbrooke, A. A. C. Swinton	3,500	800	11,000 v., 50~, 3-
Salford, Stockport,	Radcliffe	1905	C. D. Taite	H. F. Parshall; Lacey, Sillar & Leigh	8,000	2,450	10,000 volts, 50~,
.. .. ..	(Newbold-on-Avon, Whitacre, Hinkley, Glenfield and Measham, proposed)	..	.. ..	Bramwell & Harris ..	.. .. ..	.. .. ..	.. .. ..
Bradley, Compton, eath Town, Kingsenn, Princes End, enhall, Willenhall,	Ocker Hill, Tipton	1902	J. Hardie McLean ..	J. Hardie McLean ..	6,200	3,822	7,000 v., 50~, 2-p
.. .. ..	Carville and Neptune Bank	1890	R. P. Sloan (Man.), J. S. Watson (Tech. Man.)	Charles H. Merz and William McLellan	47,000	37,400	5,750 v., 40~, 3-p
es); also London	Brimsdown	1904	H. H. Perry (Res.) ..	A. H. Pott	5,000	3,600	50~, 3-ph., at 10,
	Willesden	1903	F. D. Napier (Res.) ..	E. Ruthven-Murray (Engineer-in-Chief)	5,850	2,515	50~, 3-ph., at 10, at 240, 480 and
	Hertford	1901	J. M. Bowman (Res.) ..	Do.	300	155	230 and 460 v. D.C
	St. Albans	1908	T. E. Eachus (Res.) ..	Do.	300	50	230 and 460 v. D.C
rnarvon, Blaenau	Cwm-Dyll. Snowdon. (Water power)	1905	G. K. Paton (Elec. Eng.)	.. ..	4,000	.. .. ..	10,000 volts, 50~,
.. .. ..	(Stone, Sutton and Ruabon, proposed)	..	.. ..	Lacey, Sillar & Leigh; H. A. Humphrey	.. .. ..	.. .. ..	.. .. ..
ton (400 sq. miles)	Bonnybridge	1905	E. C. Churchward (Gen. Man. and Engineer).	.. ..	2,700	800	3,000 v., 50~, 2 &
.. .. ..	Treforest and Cwmbran	1904	W. A. Chamen	.. ..	*T.* 7,500 *C.* 1,900	3,040 1,425	11,000 v., 25~, 3-
.. .. ..	Thornhill	1905	W. B. Woodhouse ..	.. ..	6,000	3,393	10,000 v., 50~, 3-p

THE HOME OFFICE REGULATIONS

For the Installation and Use of Electricity

MOUNTAIN &

IC RAILWAYS.

No. of Motor Cars.	No. of Trailers.	Power Station Capacity, Kilowatts.	Maximum Load Recorded, Kilowatts.	Maximum Output of Battery.	System of Generation.	Line Equipment.	Line Pressure.	Capital Outlaid.	Annual Train Mileage.	Passengers carried per Annum.	Ratio of Expenses to Receipts.
36	72	44,000	..	..	11,000 v. 33⅓~, 3-ph... ..	3rd and 4th rails	600 volts D.C.	£3,161,600	1,116,787	26,277,927	53.05%*
64	172	5,100	..	..	5,000 v. 25~, 3-ph.	3rd rail	500 volts D.C.	.. ..	1,456,781	41,898,373	49%
60	90	44,000	..	..	11,000 v. 33⅓~, 3-ph... ..	3rd and 4th rails	600 volts D.C.	£5,622,177	1,591,932	25,148,002	62.17%*
52 locos.	165 coaches	3,850	1,700	..	500, 1,000 & 2,000 v. D.C. ..	3rd rail	500 volts D.C.	£3,140,138 (inclusive)	1,379,683	22,893,166	46.4%
32	44	3,440	2,120	..	550 v. D.C.	3rd & 4th rails	550 v. D.C. ..	£2,010,000 authorised	681,077	12,410,000	53.14%
72	146	44,000	..	..	11,000 v. 33⅓~, 3-ph.	3rd and 4th rails	600 volts D.C.	£6,811,442	2,104,321	34,486,978	50.67%*
..	..	4,000	3,500	1,500 KW.	6,500 v., 50~, 3-ph.	3rd & 4th rails..	600 volts D.C.	.. ..	.. ..	.. .. ..	..
304-motor, 12 2-motor	52	9,750	5,000	5 bats. 6,200 A.H. total	7,500 v., 25~, 3-ph.	3rd rail & insulated return*..	600 v. D.C...	.. ..	1,550,000	.. .. ..	..
44	7	2,300	..	650 KW.	500—550 v. D.C.	3rd rail	500 volts D.C.	.. ..	844,759	8,254,855	77.80%
8 trains	..	*	..	..	6,700 v., 1-ph.	Overhead conductor, rail return	6,600 volts A.C.	.. ..	.. ..	.. .. ..	..
24	37	4,000	3,500	650 KW.	650 v. D.C.	3rd and 4th rails	600 volts D.C.	£3,595,961 (inclusive)	811,773	13,743,000	72%
161	198	44,000†	†	†	11,000 v., 33⅓~, 3-ph. ..	3rd & 4th rails..	600 volts D.C.	£10,585,478† ..	2,941,478	61,180,308	60.52
110, and 20 locos.	212	19,000	12,000	..	11,000 v. 33⅓~, 3-ph.	3rd and 4th rails	600 volts D.C.	£15,053,026	3,901,374 partly steam	99,846,735	60.31%
3	6	685	1,012	350 KW. or 1 hour	Gas driven D.C. gen. and D.C. A.C. motor gen. 6,600 v. 25~, 1-ph.	Overhead conductor, rail return	6,600 volts, 1-ph. A.C.	.. ..	.. .. ..	.. .. ..	..
65	54	†	..	..	6,000 v., 40~, 3-ph.	3rd rail	600 v. D.C. ..	.. ..	1,210,186; car-miles 3,758,797	.. .. ..	..
17	12	1,200	600	..	510—530 v. D.C.	3rd rail	500 volts D.C.	£600,000*	190,000*	5,500,000*	45%*

OWER COMPANIES.

Maximum ad recorded, Kilowatts.	System of Generation.	System of Distribution.	Total Connections of all kinds.	Capital Expended.	Price Charged per unit.	Syste
7,550	11,500 v., 40~, 3-ph.	Three-phase—Underground and Overhead	25,600 H.P.	£1,000,000 authorised	Power 1¼ to ¾d. with discounts ..	Max. de with di
4,700	11,000 v., 25~, 3-ph.	400 and 230 v. 3-ph.	14,600 KW.	£574,865	3.5 to 0.75d.	Max. dem
.. ..	.. ..	.. ..	.. .. ..	£450,000 authorised	.. ..	..
.. ..	5,750 v., 40~, 3-ph.	Transmission 20,000 volts and 5,500 volts, Cables and Overhead Lines. Distribution 440 volts.	22,000 KW.	£210,238	Power 1¼d. with discounts	..
624	11,000 v., 25~, 3-ph. and 500-550 v. D.C.	.. ..	.. .. ..	..	1.375 to 0.4d.	Max. dem
4,927	5,750 v., 40~, 3-ph.	3-core Underground Cables and Overhead Lines ..	9,250 KW.	£155,000 authorised	.. ..	..
.. ..	3,000 v., 50~, 2-ph.	.. ..	.. .. ..	£600,000 authorised	.. ..	..
.. ..	.. ..	.. ..	.. .. ..	£250,000 authorised	.. ..	..
800	11,000 v., 50~, 3-ph.	.. ..	1,946 KW.	£750,000 authorised	Lighting 7d. and 2d., or 4½d. Power 1.66 to 0.53d.	Sliding load fac
2,450	10,000 volts, 50~, 3-ph.	.. ..	5,000 H.P.	£300,000	From 0.65 to 4d.	Various
.. ..	.. ..	.. ..	.. .. ..	£750,000 authorised	.. ..	..
3,822	7,000 v., 50~, 2-ph.	200 v. per phase	6,800 KW.	£408,383	Lighting 4d., with various discounts; pr. 3 & 0.825, or 1½d., with various discounts.	Max. dem
37,400	5,750 v., 40~, 3-ph.	Transmission 20,000 volts and 5,500 volts. Three-phase, 440 volts; D.C., traction 500 and 600 volts, lighting, etc., 480 and 240 volts	83,167 KW.	£1,785,980	Lg. 3½d.; pb. lg. £2 15s. 6d. per 16-C.P. p.s.; pr. 1½d. with discounts	Flat rate
3,600	50~, 3-ph., at 10,000 v.	In bulk D.C. three-wire and 3-ph.	10,200 KW.	B. £125,000	25/- to 20/- per KW. of max. dem. per quarter, & 1d. to 0.25d. per unit metered	Contract flat rate
2,515	50~, 3-ph., at 10,000 and 2,950 v.; and direct current at 240, 480 and 550 v.	Also under Tottenham and Edmonton E.L. Orders 3-ph. 4-wire		W. £125,000		
155	230 and 460 v. D.C.	Direct	375 KW.	H. £17,500		
50	230 and 460 v. D.C.	Direct	130 KW.	A. £17,500		
.. ..	10,000 volts, 50~, 3-ph.	Overhead transmission lines 10,000 and 20,000 volts, 3-phase	3,050 B.H.P. ..	..	Approx. av. 1d., sliding scale ..	Various
.. ..	.. ..	.. ..	.. .. ..	£1,500,000 authorised	.. ..	..
800	3,000 v., 50~, 2 & 3-ph.	3,000 v., 50~, transformed to 440 v., 50~, 2 and 3-ph., at consumer's premises	.. .. ..	£600,000 authorised	Power 1.25 to 0.75d.; traction, contract	Maximum scale, contract
3,040 1,425	11,000 v., 25~, 3-ph...	.. ..	.. .. ..	..	3d. to 0.35d.	Sliding sca
3,393	10,000 v., 50~, 3-ph.	2,000 and 400 v., 3-ph.; 230 v. 1-ph.; 500 v. D.C. ..	7,500 KW.	£304,650	Terms on application	Max. dema

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THE UNI

	Passengers carried per Annum.	Ratio of Expenses to Receipts.	REMARKS.	
	26,277,927	53.05%*	Controlled by the Underground Electric Railway Co. of London, Ltd., and energy supplied from that Co's. Chelsea power station. *Including rates and taxes.	1
	41,898,373	49%	Separate tunnels. Four rotary-converter substations. Multiple-unit control, 7, 6 and 3-car trains, 2-minute service	2
	25,142,002	62.17%*	Controlled by the Underground Electric Railways Co. of London, Ltd., and energy supplied from that Co's. Chelsea power station. *Including rates and taxes	3
	22,893,166	46.4%	First electric railway constructed. Separate tunnels. Energy transmitted to substations at 1,000 and 2,000 volts D.C.	4
	12,410,000	53.14%	Separate tunnels. Two conductor rails, feeder. Multiple-unit control	5
	34,436,978	50.67%*	Controlled by the Underground Electric Railways Co. of London, Ltd., and energy supplied from that Co's. Chelsea power station. *Including rates and taxes	6
.. .. ..	..		Three motor-generator substations, two with batteries. Park Royal power station, built by G.W.R., also supplies power and light to stations and goods yards in the London district(2,000 KW. additional provided for this purpose).	7
.. .. ..	..		*Third rail outside track; fourth rail between running rails (no collector on it). Direct and multiple unit control. Four rotary-converter substations, and five batteries. Four-coach trains, 8 150-H.P. motors per train; also multiple-unit coaches, two 125-H.P. motors per coach.	8
	8,254,855	77.80%	The Railway Co. constructed the Seaforth & Gt. Crosby tramways; power transmitted from railway power station to tramway substation at 1,100 v. D.C. Works cost per unit generated, 0.3905d.	9
.. .. ..	..		Single-phase A.C. motors; direct supply from power station to overhead conductor at 6,600 volts. *Energy purchased	10
	13,743,000	72%	Tunnel railway under River Mersey, formerly worked by steam (opened 1886). Third rail outside, return rail between running rails ..	11
	61,180,308	60.52	Converted from steam. Turbine power station, 11 rotary-converter substations. Multiple-unit control. *Also joint owners of 4 miles, running powers over 20 miles, in addition. †Chelsea Power station, belongs to the Underground Electric Railways Co. of London.	12
n	99,846,735	60.31%	Turbine power station. Third and fourth rails outside running rails. Multiple-unit control. Rotary-converter substations. Total mileage worked over, 78 miles (inc. 51½ G. C. Joint, not worked electrically).	13
.. .. ..	..		Single-phase A.C. motors; no feeders or transformers. *Lancaster-Morecambe, 30 miles p. h.; Morecambe-Heysham, 21.5 miles p. h., exclusive of stops. Speed restricted to 10 miles p. h. at all three stations.	14
ar-	..		Rotary-converter substations. Multiple-unit control. 2 locos. for goods traffic. *Route miles of running lines electrified to present time. †Power supplied by Newcastle-on-Tyne Electric Supply Co. from Carville turbine power station.	15
	5,500,000*	45%*	Separate tunnels. Third rail between track rails. Line owned by L. & S.-W. Ry. Co. *Approximate figures	16

arged per unit.	System of Charging.	Units Sold during last complete Year.	Remarks.	
with discounts ..	Max. demand and flat rate with discounts	.. .. ..	Bulk supply to Middlesbrough. Address: Hinton's Buildings, Middlesbrough. Sec., A. Gemmell. * Supply in bulk is also obtained from the stations of The Waste Heat and Gas Electrical Generating Stations, Ltd., at Newport, Weardale, Teesbridge and elsewhere	1
.. ..	Max. demand	.. .. ..	Yoker started August, 1905, and Motherwell January, 1906. Address: 53, Bothwell St., Glasgow. Sec., Robert Robertson	2
.. ..	.. ..	.. .. ..	Supply not commenced. Shares in Company now held by the Urban Electric Supply Co., whose generating station is situated at Carn Brea, and supplies the districts of Camborne and Redruth, and surrounding country	3
n discounts	.. ..	.. .. ..	Sec., N. H. Firmin, Royal Exchange Buildings, Newcastle-upon-Tyne.	4
.. ..	Max. demand & sliding scale	910,163	Offices: 53, Temple Chambers, Temple Avenue, London. Sec., G. D. Prince	5
.. ..	.. ..	.. .. ..	*Also supplies Sunderland and District Tramways Co. at 0.75d. per unit. Lambton & Hetton Collieries. †System operated by the Newcastle-upon-Tyne Electric Supply Company, Ltd. Sec., S. W. Hemmin. Basildon House, E.C.	6
.. ..	.. ..	.. .. ..	Statistics not yet available	7
.. ..	.. ..	.. .. ..	Supply not commenced. Sec., J. French, 5, Rowcroft, Stroud, Glos.	8
d 2d., or 4½d. Power	Sliding scale depending on load factor	1,018,372	Supply from Frindsbury Power Station commenced January 1, 1907. Sec., F. A. H. Walker, Frindsbury Power House, Strood, Kent.	9
.. ..	Various	5,880,847	Office, 196, Deansgate, Manchester	10
.. ..	.. ..	.. .. ..	Registered offices: 5, Great George Street, S.W.	11
with various dis- & 0.825, or 1½d., with nts.	Max. demand & flat rate ..	6,671,627	Sec., G. Saice, 14, Dale Street, Liverpool	12
lg. £2 15s. 6d. per . 1½d. with discounts	Flat rate and max. demand ..	.. .. ..	Sec., M. Short, Royal Exchange Bldgs., Newcastle-upon-Tyne. New station under construction at Dunston	13
KW. of max. dem. & 1d. to 0.25d. per	Contract on max. demand & flat rate	14,069,611	Supply in bulk to Willesden U.D.C., Stoke Newington B.C., Hendon Electric Supply Co., Ltd., North Met. E.P. Distribution Co., Ltd., at Barnet, Enfield, Hertford, St. Albans, etc., and to Edmonton and Tottenham, under E.L. Orders. Also to Met. Elec. Tramways, the Middlesex and Hertfordshire County Light Railways, and to numerous Power Consumers.	14
sliding scale ..	Various	.. .. ..	Quarry supply at 500 volts, 50~, 3-phase. Sec., R. B. Humphreys, Old Bank Buildings, Chester	15
.. ..	.. ..	.. .. ..	Sec., B. Fleming, 37, Cross Street, Manchester. The Company has not yet commenced operations	16
75d.; traction, con-	Maximum demand, sliding scale, 3-rate meter and contract	1,500,000	Operations commenced end of 1905. Sec., Jas. Walker, 25, Frederick Street, Edinburgh. (Head Office) Commercial Bank Buildings, Kirk Wynd, Falkirk	17
.. .. ..	Sliding scale	9,506,000	Sec., G. P. Tutcher, Royal Chambers, Queen St., Cardiff. Treforest and Cwmbran areas now being worked by Treforest Electrical Consumers' Co., Ltd.	18
ation	Max. demand	.. .. ..	Address: Thornhill, near Dewsbury. Sec., J. J. H. Stansfield	19

THE UNITED ELECTRIC

HART

	Name of Power Company.	Districts Served.
1	CLEVELAND & DURHAM COUNTY ELECTRIC POWER CO.	North Riding of Yorkshire and part of Durham County (820 sq. miles
2	CLYDE VALLEY ELECTRIC POWER CO.	Parts of Lanark, Renfrew, Dumbarton and Stirling (750 sq. miles)
3	CORNWALL ELECTRIC POWER CO.	County of Cornwall
4	COUNTY OF DURHAM ELECTRIC POWER SUPPLY CO.	County of Durham (250 sq. miles)
5	DERBYSHIRE & NOTTINCHAMSHIRE ELECTRIC POWER CO.	County of Nottingham and part of the County of Derby (1,570 sq. mil
6	DURHAM COLLIERIES ELECTRIC POWER SUPPLY CO.	Durham Colliery District*
7	FIFE ELECTRIC POWER CO.	County of Fife
8	GLOUCESTERSHIRE ELECTRIC POWER CO.	County of Gloucester
9	KENT ELECTRIC POWER CO.	County of Kent, except Isle of Thanet
10	LANCASHIRE ELECTRIC POWER CO.	Lancashire south of the Ribble, excluding Manchester, Salford, Stocky part of Bolton, Liverpool and Bootle
11	LEICESTERSHIRE & WARWICKSHIRE ELECTRIC POWER CO.	Counties of Leicester and Warwick (1,340 sq. miles)
12	MIDLAND ELECTRIC CORPORATION FOR POWER DISTRIBUTION, LTD.	Amblecote, Brettell Lane, Brierley Hill, Bilston, Bradley, Comp Cradley Heath, Darlaston, Deepfields, Finchfield, Heath Town, Ki winford, Lye, Lower Gornal, Old Hill, Ocker Hill, Penn, Princes E Pensnett, Quarry Bank, Short Heath, Tipton, Tettenhall, Willenh Wednesfield, Wordsley, Wednesbury.
13	NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.	Part of Northumberland (370 sq. miles)
14	NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO.	Counties of Middlesex, Hertford & Essex (326 sq. miles); also Lon (Stoke Newington)
15	NORTH WALES POWER & TRACTION CO., LTD.	Supplies slate quarries in the neighbourhood of Carnarvon, Blae Festiniog, &c.
16	NORTH-WESTERN ELECTRICITY & POWER CAS CO.	Parts of Stafford, Derby, Flint and Denbigh
17	SCOTTISH CENTRAL ELECTRIC POWER CO.	Linlithgow, Clackmannan, parts of Stirling and Dumbarton (400 sq. mi
18	SOUTH WALES ELECTRICAL POWER DISTRIBUTION CO.	Glamorganshire and part of Monmouth (1,034 sq. miles)
19	YORKSHIRE ELECTRIC POWER CO.	Yorkshire (West Riding) 1,800 sq. miles

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s Served.	Generating Stations.	Year of Opening.	Engineer and Manager.	Consulting Engineers.	Power Station capacity, Kilowatts.
of Durham County (820 sq. miles) ..	Grangetown*	1904	A. B. Gridley (Man.) ..	Charles H. Merz and William McLellan	6,500
on and Stirling (750 sq. miles) ..	Yoker and Motherwell	1905	David A. Starr	Strain & Robertson ..	8,000
.. ..	(St. Blazey and Phillack, proposed)	..	.. ..	.. ..	.. .. ..
.. ..	Supplied in bulk by Newcastle-upon-Tyne Electric Supply Co.	1902	A. S. Esslemont (Man.) ..	Charles H. Merz and William McLellan.	.. .. ..
e County of Derby (1,570 sq. miles)..	Ilkeston (Newark and Sutton-in-Ashfield, proposed)	1903	A. E. Loos (Gen. Man.)..	.. ..	1,500
.. ..	Philadelphia	1906	†See "Remarks" ..	†See "Remarks" ..	11,000
.. ..	Townhill	1905	J. S. Thomson (Gen. Man.)	.. ..	600
.. ..	Stroud and West Dean	..	.. ..	G. L. Addenbrooke ..	.. .. ..
.. ..	Frindsbury (Strood, Blean, Dover & Tonbridge, proposed)	1907	B. H. Harvey (Man.) ..	G. L. Addenbrooke, A. A. C. Swinton	3,500
ding Manchester, Salford, Stockport, e	Radcliffe	1905	C. D. Taite	H. F. Parshall; Lacey, Sillar & Leigh	8,000
1,340 sq. miles)	(Newbold-on-Avon, Whitacre, Hinkley, Glenfield and Measham, proposed)	..	.. ..	Bramwell & Harris ..	.. .. ..
Hill, Bilston, Bradley, Compton, lds, Finchfield, Heath Town, Kings-Hill, Ocker Hill, Penn, Princes End, ath, Tipton, Tettenhall, Willenhall, y. s)	Ocker Hill, Tipton	1902	J. Hardie McLean ..	J. Hardie McLean ..	6,200
	Carville and Neptune Bank	1890	R. P. Sloan (Man.), J. S. Watson (Tech. Man.)	Charles H. Merz and William McLellan	47,000
Essex (326 sq. miles); also London	Brimsdown	1904	H. H. Perry (Res.) ..	A. H. Pott..	5,000
	Willesden	1903	F. D. Napier (Res.) ..	E. Ruthven-Murray (Engineer-in-Chief)	5,850
	Hertford	1901	J. M. Bowman (Res.) ..	Do.	300
	St. Albans	1908	T. E. Eachus (Res.) ..	Do.	300
hbourhood of Carnarvon, Blaenau	Cwm-Dyli. Snowdon. (Water power)	1906	G. K. Paton (Elec. Eng.)	.. ..	4,000
enbigh	(Stone, Sutton and Ruabon, proposed)	..	.. ..	Lacey, Sillar & Leigh; H. A. Humphrey	.. .. ..
rling and Dumbarton (400 sq. miles)	Bonnybridge	1905	E. C. Churchward (Gen. Man. and Engineer).	.. ..	2,700
h (1,034 sq. miles)	Treforest and Cwmbran	1904	W. A. Charnen	.. ..	*T.* 7,500 *C.* 1,900
es	Thornhill	1905	W. B. Woodhouse ..	.. ..	6,000

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	22	85 lb.	130 lb.	110, and 20 locos.	212	19,000	12,000	..	11,000 v. 33⅓~, 3-ph.	3rd and 4th rails	600 volts D.C.	£15,053,026	3,901,97 partly ste
	30 and 21.5*	85 lb.	Overhead	3	6	685	1,012	350 KW. or 1 hour	Gas driven D.C. gen. and D.C. A.C. motor gen. 6,600 v. 25~, 1-ph.	Overhead conductor, rail return	6,660 volts, 1-ph. A.C.	.. ..	.. ..
	20.5	90 lb.	80 lb.	65	54	†	..	..	6,000 v., 40~, 3-ph.	3rd rail	600 v. D.C. ..	.. ..	1,210,186 ; miles 3,758
	18	87 lb.	46 lb.	17	12	1,200	600	..	510—530 v. D.C.	3rd rail	500 volts D.C.	£600,000*	190,000

IC POWER COMPANIES

nsulting Engineers.	Power Station capacity, Kilowatts.	Maximum load recorded, Kilowatts.	System of Generation.	System of Distribution.	Total Connections of all kinds.	Capital Expended.	Price Cl
rles H. Merz and William McLellan	6,500	7,550	11,500 v., 40~, 3-ph.	Three-phase—Underground and Overhead	25,600 H.P.	£1,000,000 authorised	Power 1¼ to ⅜d
in & Robertson ..	8,000	4,700	11,000 v., 25~, 3-ph.	400 and 230 v. 3-ph.	14,600 KW.	£574,865	3.5 to 0.75d.
.. ..	.. .. ..	.. .. ..	.. ..	.. ..	.. .. ..	£450,000 authorised	.. ..
rles H. Merz and William McLellan.	.. .. ..	.. .. ..	5,750 v., 40~, 3-ph.	Transmission 20,000 volts and 5,500 volts, Cables and Overhead Lines. Distribution 440 volts.	22,000 KW.	£210,238	Power 1½d. wit
.. ..	1,500	624	11,000 v., 25~, 3-ph. and 500-550 v. D.C.	.. ..	.. .. ..	..	1.375 to 0.4d.
e "Remarks" ..	11,000	4,927	5,750 v., 40~, 3-ph.	3-core Underground Cables and Overhead Lines ..	9,250 KW.	£155,000 authorised	.. ..
.. ..	600	.. .. ..	3,000 v., 50~, 2-ph.	.. ..	.. .. ..	£600,000 authorised	.. ..
L. Addenbrooke ..	.. .. ..	.. .. ..	.. ..	.. ..	.. .. ..	£250,000 authorised	.. ..
L. Addenbrooke, . A. C. Swinton	3,500	800	11,000 v., 50~, 3-ph.	.. ..	1,946 KW.	£750,000 authorised	Lighting 7d. an 1.66 to 0.52d.
F. Parshall; Lacey, illar & Leigh	8,000	2,450	10,000 volts, 50~, 3-ph.	.. ..	5,000 H.P.	£300,000	From 0.65 to 4d
mwell & Harris ..	.. .. ..	.. .. ..	.. ..	.. ..	.. .. ..	£750,000 authorised	.. ..
Hardie McLean ..	6,200	3,822	7,000 v., 50~, 2-ph.	200 v. per phase	6,800 KW.	£408,383	Lighting 4d., counts ; pr. 3 various disco
rles H. Merz and William McLellan	47,000	37,400	5,750 v., 40~, 3-ph.	Transmission 20,000 volts and 5,500 volts. Three-phase, 440 volts; D.C., traction 500 and 600 volts, lighting, etc., 480 and 240 volts	83,167 KW.	£1,785,980	Lg. 3¾d.; pb. 16-C.P. p.a.; pr
H. Pott..	5,000	3,600	50~, 3-ph., at 10,000 v.	In bulk D.C. three-wire and 3-ph.	10,200 KW.	B. £125,000 W. £125,000	25/- to 20/- pe per quarter, unit metered
Ruthven-Murray (Engineer-in-Chief)	5,850	2,515	50~, 3-ph., at 10,000 and 2,950 v.; and direct current at 240, 480 and 550 v.	Also under Tottenham and Edmonton E.L. Orders 3-ph. 4-wire			
.. ..	800	165	230 and 460 v. D.C.	Direct	375 KW.	H. £17,500	
.. ..	300	50	230 and 460 v. D.C.	Direct	130 KW.	A. £17,500	
. .. .	4,000	.. .. ..	10,000 volts, 50~, 3-ph.	Overhead transmission lines 10,000 and 20,000 volts, 3-phase	3,050 B.H.P. ..	..	Approx. av. 1d ,
cey, Sillar & Leigh ; I. A. Humphrey	.. .. ..	.. .. ..	.. ..	.. ..	.. .. ..	£1,500,000 authorised	.. ..
.. ..	2,700	800	3,000 v., 50~, 2 & 3-ph.	3,000 v., 50~, transformed to 440 v., 50~, 2 and 3-ph., at consumer's premises	.. .. ..	£600,000 authorised	Power 1.25 to 0. tract
.. ..	T. 7,500 C. 1,900 / 3,040 1,425		11,000 v., 25~, 3-ph...	.. ..	.. .. ..	..	3d. to 0.35d.
.. ..	6,000	3,393	10,000 v., 50~, 3-ph.	2,000 and 400 v., 3-ph. ; 230 v. 1-ph. ; 500 v. D.C. ..	7,598 KW.	£304,650	Terms on applic

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THE

COMMERCIAL ENGINEER'S POCKET BOOK.

ELECTRICITY SUPPLY.

A Handbook for Publicity Department Managers, Electricity Supply and Contractors' Representatives.

By FRANCIS H. DAVIES, A.M.I.E.E.

H. ALABASTER, GATEHOUSE & CO.

4, Ludgate Hill, London, E.C.

3,901,374 partly steam	99,846,735	60.31%	Turbine power station. Third and fourth rails outside running rails. Multiple-unit control. Rotary-converter substations. Total mileage worked over, 78 miles (inc. 51½ G. C. Joint, not worked electrically).	13
.. .. ..	.. .. ..	..	Single-phase A.C. motors; no feeders or transformers. *Lancaster-Morecambe, 30 miles p. h.; Morecambe-Heysham, 21.5 miles p. h., exclusive of stops. Speed restricted to 10 miles p. h. at all three stations.	14
1,210,186; car-miles 3,758,797	.. .. ..	..	Rotary-converter substations. Multiple-unit control. 2 locos. for goods traffic. *Route miles of running lines electrified to present time. †Power supplied by Newcastle-on-Tyne Electric Supply Co. from Carville turbine power station.	15
190,000*	5,500,000*	45%*	Separate tunnels. Third rail between track rails. Line owned by L. & S.-W. Ry. Co. *Approximate figures	16

E S.

Price Charged per unit.	System of Charging.	Units Sold during last complete Year.	Remarks.	
Power 1½ to ¾d. with discounts ..	Max. demand and flat rate with discounts	.. .. ..	Bulk supply to Middlesbrough. Address: Hinton's Buildings, Middlesbrough. Sec., A. Gemmell. * Supply in bulk is also obtained from the stations of The Waste Heat and Gas Electrical Generating Stations, Ltd., at Newport, Weardale, Teesbridge and elsewhere	1
3.5 to 0.75d.	Max. demand	.. .. ..	Yoker started August, 1905, and Motherwell January, 1906. Address: 53, Bothwell St., Glasgow. Sec., Robert Robertson	2
.. ..	.. ..	.. .. ..	Supply not commenced. Shares in Company now held by the Urban Electric Supply Co., whose generating station is situated at Carn Brea, and supplies the districts of Camborne and Redruth, and surrounding country	3
Power 1½d. with discounts	.. ..	.. .. ..	Sec., N. H. Firmin, Royal Exchange Buildings, Newcastle-upon-Tyne.	4
1.375 to 0.4d.	Max. demand & sliding scale	910,163	Offices: 53, Temple Chambers, Temple Avenue, London. Sec., G. D. Prince	5
.. ..	.. ..	.. .. ..	*Also supplies Sunderland and District Tramways Co. at 0.75d. per unit. Lambton & Hetton Collieries. †System operated by the Newcastle-upon-Tyne Electric Supply Company, Ltd. Sec., S. W. Hemmin. Basildon House, E.C.	6
.. ..	.. ..	.. .. ..	Statistics not yet available	7
.. ..	.. ..	.. .. ..	Supply not commenced. Sec., J. French, 5, Rowcroft, Stroud, Glos.	8
Lighting 7d. and 2d., or 4½d. Power 1.66 to 0.52d.	Sliding scale depending on load factor	1,018,372	Supply from Frindsbury Power Station commenced January 1, 1907. Sec., F. A. H. Walker, Frindsbury Power House, Strood, Kent.	9
From 0.65 to 4d.	Various	5,380,847	Office, 196, Deansgate, Manchester	10
.. ..	.. ..	.. .. ..	Registered offices: 5, Great George Street, S.W.	11
Lighting 4d., with various discounts; pr. 3 & 0.825, or 1½d., with various discounts.	Max. demand & flat rate ..	6,671,627	Sec., G. Sales, 14, Dale Street, Liverpool	12
Lg. 3¾d.; pb. lg. £2 15s. 6d. per 16-C.P. p.a.; pr. 1½d. with discounts	Flat rate and max. demand ..	.. .. ..	Sec., M. Short, Royal Exchange Bldgs., Newcastle-upon-Tyne. New station under construction at Dunston	13
25/- to 20/- per KW. of max. dem. per quarter, & 1d. to 0.25d. per unit metered	Contract on max. demand & flat rate	14,069,611	Supply in bulk to Willesden U.D.C., Stoke Newington B.C., Hendon Electric Supply Co., Ltd., North Met. E.P. Distribution Co., Ltd., at Barnet, Enfield, Hertford, St. Albans, etc., and to Edmonton and Tottenham, under E.L. Orders. Also to Met. Elec. Tramways, the Middlesex and Hertfordshire County Light Railways, and to numerous Power Consumers.	14
Approx. av. 1d, sliding scale ..	Various	.. .. ..	Quarry supply at 500 volts, 50~, 3-phase. Sec., R. B. Humphreys, Old Bank Buildings, Chester	15
.. ..	.. ..	.. .. ..	Sec., R. Fleming, 37, Cross Street, Manchester. The Company has not yet commenced operations	16
Power 1.25 to 0.75d.; traction, contract	Maximum demand, sliding scale, 2-rate meter and contract	1,500,000	Operations commenced end of 1905. Sec., Jas. Walker, 25, Frederick Street, Edinburgh. (Head Office) Commercial Bank Buildings, Kirk Wynd, Falkirk	17
d. to 0.35d.	Sliding scale	9,596,000	Sec., G. P. Tutcher, Royal Chambers, Queen St., Cardiff. Treforest and Cwmbran areas now being worked by Treforest Electrical Consumers' Co., Ltd.	18
Terms on application	Max. demand	.. .. ..	Address: Thornhill, near Dewsbury. Sec., J. J. H. Stansfield	19

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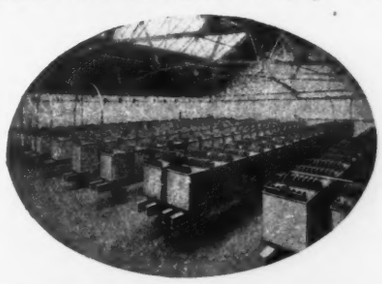

CENTRAL STATION BATTERIES.

WITH OR WITHOUT BOOSTERS.

WRITE FOR 1909 CATALOGUE.

STRATFORD, LONDON.

between Montreal and Glace Bay for telegrams transmitted by wireless from the latter place across the Atlantic. At present the private message rates are enforced.

The *Journal Télégraphique* states that various Continental Governments are about to pass laws making it obligatory for passenger steamers to be fitted with wireless.

Arrangements have now been completed in connection with the erection of a wireless telegraph station at Castland Hill, overlooking the Rosyth Naval Base, for the use of the Admiralty. The contract for its erection has been placed with Messrs. G. & R. Cousin, Edinburgh, and work is to commence immediately. A year will elapse before the station and apparatus are ready for use.

The value of wireless telegraphy to ships was further exemplified in connection with the wreck of the *Slavonia* at the Azores last week; the *Princess Irene* and the *Batavia* were called to her assistance by the Marconi system, and took on board the 600 passengers.

Wireless Telephony.—Further successful experiments have been carried out by the French Government with the apparatus of Lieutenants Colin and Jéance. The experiments, with much shorter antennæ than those previously used, gave even more satisfactory results. The cruiser *Condé* in daylight received messages from a distance of 105 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Acton.—July 12th. Lead-covered paper-insulated cables for the U.D C. See "Official Notices" to-day.

Australia.—MELBOURNE.—July 14th. One direct-current steam-driven generating set of 1,000, 1,250 or 1,500 KW., for the Council. See "Official Notices" May 14th.

MELBOURNE.—August 4th. Overhead travelling crane, for the Electricity Supply Committee. See "Official Notices" June 4th.

MELBOURNE.—August 4th. Overhead travelling crane for the Council. See "Official Notices" June 11th.

MELBOURNE.—July 7th. 18 transformers for the City Council. See "Official Notices" to-day.

Bedford.—June 26th. One 30 ft. × 8 ft. Lancashire boiler, with pipe work and superheater, for the Corporation. See "Official Notices" June 11th.

Belfast.—Feeder panels for lighting switchboard in the Corporation electricity supply works. See "Official Notices" June 11th.

Bristol.—June 28th. Cables and fittings, &c., for the electric lighting at Portishead Dock for the Docks Committee of the Council. Specification (deposit £3) from Mr. W. W. Squire, engineer, Cumberland Road, Bristol.

Burslem.—June 29th. One 600-KW. steam dynamo or turbo-generator; condensing plant, water-tube boiler, and switchgear, for the Corporation. See "Official Notices" June 11th.

Eastbourne.—Quotations are to be obtained by the electrical engineer for the installation of a plant having a capacity of 1,000 gallons per hour for softening the town water, which is used for making up the additional quantity required over that obtained from the borehole, which now produces 10,128 gallons per day.

Eccles.—June 21st. Water-softening and purifying plant (3,000 gallons per hour) for the electricity works. Deposit one guinea to the borough electrical engineer.

Exminster.—June 30th. Electrical appliances for a year for the Devon County Lunatic Asylum. H. E. Morgan, Clerk.

Felixstowe and Walton.—June 21st. Cooling tower and tank, water softener and ventilating shaft, for the U.D.C. See "Official Notices" June 11th.

Germany.—June 22nd. The Prussian State Railway authorities in Altona are inviting tenders for the supply of 18,000 metres of underground telegraph cable.

Gillingham.—June 28th. Coal for the Council's Electricity Department. See "Official Notices" June 11th.

Gravesend.—July 3rd. Automatic stoker for the Electricity Committee. See "Official Notices" June 11th.

Ipswich.—June 23rd. Rubber-insulated wires and paper-insulated lead-sheathed cables for the Electricity Supply Department. See "Official Notices" June 11th.

Leeds.—June 24th. Electric light installation at new skating rink, Roundhay Road, for Leeds Olympia, Ltd. (deposit 10s.); Myers-Beswick & Partners, engineers, 8, Park Square, Leeds.

London.—ST. PANCRAS.—July 10th. Arc lamp carbons for the B.C. See "Official Notices" April 30th.

BERMONDSEY.—June 25th. High-pressure steel plate forced draught fan, also a steel plate exhaust fan for the Electricity Committee. See "Official Notices" to-day.

STEPNEY.—The B.C. is shortly to invite tenders for meters, demand indicators, time switches and carbons. Tenders for 12,000 tons of Welsh smokeless coal are to be invited.

Rotherham.—June 28th and July 13th. Cable and meters for the Electricity Department. See two "Official Notices" to-day.

Spain.—The municipal authorities of Vall de Uxe (province of Castellon) have just invited tenders for the concession for the electric lighting of the town during a period of 25 years.

Stevenage.—The U.D.C. is prepared to receive applications from companies or persons willing to carry out its provisional order. See "Official Notices" June 11th.

Stretford (Lancs.).—A sub-committee of the Electricity Committee is inquiring into the question of the provision of a coal conveyor for the generating station. Tenders are to be invited for a motor tower wagon.

Whitehaven.—July 20th. Lighting the Harbour Quays for five years, by electricity, gas, or other means, for the Harbour Commissioners. See "Official Notices" June 11th.

Worksop.—June 29th. Underground cables for the U.D.C. See "Official Notices" to-day.

CLOSED.

Bedford.—The Education Committee has accepted the tender of Mr. W. Appleby, Bedford, for electrician's work at the schools for six months.

Burnley.—The E.L. Committee has accepted the tender of the British Insulated & Helsby Cables, Ltd., for ·06 sq. in. and ·3 sq. in. cable.

Devonport.—The E.L. Committee has accepted the tender of Messrs. Corse & Co., Plymouth, for the installation of the electric light at the Higher Elementary Schools, at £238.

France.—The French War Authorities in Paris have just placed a contract with La Société des Tréfileries du Havre for the supply of 3,325 km. of bronze telephone cable.

Gillingham (Kent).—The T.C. received the following tenders for a Diesel engine and alternator:—

Electric Construction Co.—120-KW. Diesel engine, £2,450; 134-KW. ditto, £2,470; 120-KW. Mirrlees engine, £2,430; 135-KW. ditto, £2,490.
British Westinghouse Co., Ltd.—120-KW. Mirrlees engine, £2,500; 140-KW. ditto, £2,500.
Crompton & Co., Ltd.—120-KW. Diesel engine, £2,503; 135 to 140-KW. ditto, £2,668; 120-KW. Mirrlees, £2,571; 135 to 140-KW. ditto, £2,571.
British Thomson-Houston Co., Ltd.—120-KW. Mirrlees, £2,510; 135-KW. ditto, £2,510.
General Electric Co., Ltd.—120-KW. Diesel, £2,457; 140-KW. ditto, £2,540; 120-KW. Mirrlees, £2,416; 134-KW. ditto, £2,457.
Electromotor and Dynamo Co., Ltd.—120-KW. Diesel, £2,479; 140-KW. ditto, £2,653.
Mirrlees, Bickerton & Day (all Mirrlees engines with different alternators).—120-KW., £2,427, £2,441, £2,512, £2,508; 135-KW., £2,445, £2,451, £2,524, £2,583.
Diesel Engine Co. (all Diesel engines with different alternators).—120-KW., £2,435, £2,392, £2,455, £2,482, £2,472; 135 to 140-KW., £2,484, £2,455, £2,495, £2,580, £2,608, £2,650.

The Council has accepted the tender of the Electric Construction Co. for a 135-140-KW. Mirrlees-Diesel-E.C.C. set at £2,420, provided that arrangements can be made between them and Mirrlees, Bickerton & Day so that the contract for the whole plant can be placed directly with that firm. Failing that, the tender of Mirrlees, Bickerton & Day for a 130-140-KW. Mirrlees-Diesel-Brush set, at £2,445, is to be accepted.

Glasgow.—The Electricity Committee has recommended that the following offers for providing and erecting motor-generators and rotary converters for the coming year be accepted:—Messrs. Bruce Peebles & Co. for one 1,000-KW. motor-generator, at £2,280; the British Westinghouse Electric and Manufacturing Co. for one 500-KW., 500-volt rotary converter; the British Thomson-Houston Co. for one 250-KW., 500-volt rotary converter, at £1,568; and that of the latter firm for one 250-KW., 210-volt rotary converter, at £1,632; these offers were the lowest. Messrs. Matthew & Yates have secured the contract for providing and fitting up fans for cooling towers at the St. Andrew's Cross station, their offer, which was the lowest, being £1,049.

Ilford.—The U.D.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for one to four double-deck tramcars with covered tops, at £561 each.

Italy.—The Italian Post and Telegraph authorities in Rome have just placed a contract with the Société Industrielle des Téléphones, of Paris, for the supply of 320 km. of telephone cable.

London.—ST. PANCRAS.—The B.C. has accepted the following tenders for coal for the electricity undertaking:—

J. H. Beattie & Co., 8,000 tons Mansfield Nutty Slack, 11s. 3d. per ton, and 2,000 tons Hucknall Main Nuts, 14s.
Brentnall & Cleland, 2,000 tons Arley Nuts, and 2,000 tons Kingsbury Nuts, 12s. 7d. per ton, and 400 tons Bwlfa Welsh, 21s. 3d. per ton.

STOKE NEWINGTON.—The B.C. has accepted the tender of the British Thomson-Houston Co. for the supply of electricity meters for two years.

WOOLWICH.—At the meeting of the B.C. on June 10th, the Electricity Committee reported that it had completed its inquiries as to the fair conditions of employment observed by the firms tendering for 2,100 yards of 3-core ·025 E.H.T. cable, and recommended that the tender of W. T. Henley's Telegraph Works Co., Ltd., at £384 10s., be accepted. This was agreed to. The following tenders were received:—

W. T. Henley's Telegraph Works Co., Ltd. (accepted) ..	£384
Western Electric Co.	393
Siemens Bros. & Co., Ltd.	391
W. T. Glover & Co., Ltd.	393
Johnson & Phillips, Ltd.	395
Callender's Cable & Construction Co. Ltd.	396

FULHAM.—It is proposed to contract with the Magneta Time Co, Ltd., to fix six electrically synchronised clocks in the new Central Library Building (£25).

STEPNEY.—The B.C. has accepted the tender of Newton Chambers and Co., Ltd., at £159, for removing the tank and pipework from the Osborn Street station and re-erecting it at Blyth's Wharf.

The tender of Foster Bros., Ltd., at £3,989, for pipework, hotwell, &c., and that of the Rees Roturbo Manufacturing Co., Ltd., for motor-driven pumps, at £1,969, are recommended for acceptance.

The T.C. has accepted the following tenders for eight feeder boxes, eleven distributing boxes and six disconnecting boxes:—

J. Every.—Feeder boxes, £89 10s.
W. Cottis & Sons.—Distributing boxes, £125 10s.
W. Lucy & Co.—Disconnecting boxes, £26 11s.

The other tenders were:—

	Feeder boxes.	Distributing boxes.	Disconnecting boxes.
Universal Electrical Manufacturing Co.	£107	£151	£33
British Insulated & Helsby Cables ..	115	154	39
.. .. (alternative)	98	148	30
Henley's Telegraph Works Co.	138	236	31
T. Richmond	144	247	42

New Zealand.—The New Zealand Government has accepted the tender of Mr. Percy Pitman, of 3, Willcott Road, Acton, W., for two hydraulic governors for regulating the speed of two 80-B.H.P. Pelton wheels which are used for driving stone-crushing plant at the Mount Egmont Branch Railway, New Zealand. Mr. Pitman has sent us a circular describing this patent governor.

Plymouth.—The Electricity and Tramway Committees have accepted the following tenders:—

Cory Bros.—5,000 tons coal, same as now used, at 8d. per ton advance.
J. Bibby, Sons & Co.—½ ton sheet copper, at £87 15s.
Watlington & Co.—Copper wire, bracket fittings, section insulators, &c.
Blackwell & Co.—Ears, frogs, &c.

The electric lighting of the new Carnegie Free Library and Museum (cost £25,000) has been given to the local firm of Heath and Co.

Putney.—The Wandsworth B.C. is contracting with Mr. H. J. Whitehead for altering the electric lighting installation at the Public Library. The list of tenders is interesting because of the difference between the highest and lowest for so a small contract:—

Murrin, Mr. W. G., Wandsworth	£180
Dakin & Co., Putney	122
Wright Bros. & Co.	116
Henderson, Mr. J. H., Clapham	93
Tucker & Co., Putney	97
Weekes Bros., Clapham	91
Whitehead, Mr. H. J., Wandsworth	85

Stoke-on-Trent.—The B. of G. has accepted the tender of the District Electric Co., Wolverhampton, for the installation of the electric light at the Cottage Homes, at £334.

Stretford.—The D.C. has accepted the tender of the British Insulated & Helsby Cables, Ltd., for cables, 0·3 at 4s. 3d. per yard, and 0·15 at 2s. 5d. per yard.

Warrington.—The T.C. has accepted the tender of the St. Helens Cable Co., Ltd., at £692, for cables.

Whitehaven.—The T.C. has accepted the tender of the Phœnix Dynamo Co. for a new balancer for the electric light ation.

Wolverhampton.—The District Electric Co., Ltd., of Wolverhampton and Birmingham, have secured the order for the installation of electric light in St. Peter's Collegiate Church, Wolverhampton.

FORTHCOMING EVENTS.

Incorporated Municipal Electrical Association.—Monday, June 21st to 25th. Annual Convention at Manchester. For list of papers and arrangements see ELECTRICAL REVIEW for April 23rd and May 21st.

Physical Society.—Friday, June 25th. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "The Measurement of Wave-Length for High-Frequency Electrical Oscillations," by Mr. A. Campbell; "An Electromagnetic Method of Studying the Theory of and Solving Algebraical Equations of any Degree," by Mr. A. Russell; "Exhibition of a New Fery Thermo-Electric Calotimeter," by Mr. C. V. Drysdale; "An Instrument for Measuring the Strength of an Intense Horizontal Magnetic Field," by Mr. F. W. Jordan.

NOTES.

The Engineering Trades in 1908.—The fifty-eighth annual report of the Amalgamated Society of Engineers, so-called, covering the year 1908, was recently issued. The general secretary, in his introductory remarks, states that the membership decreased by 1,964 during the year, amounting to 108,120 at its close; this decrease followed increases of five and six thousand, and was mainly due to exclusions, as 7,044 new members were enrolled, and only 1,321 were removed by death. The balance in the general fund at the commencement of the year was £493,016, and at the end of it £324,472, showing a loss of £168,544, as compared with a gain of about half that amount in the preceding year; this is attributed to the N.E. Coast dispute. The superannuation reserve fund was raised to £348,729, and the aggregate funds decreased to £673,201. The income from all sources was £490,658, as compared with £424,000 in the previous year.

The output of British shipping fell below that of foreign countries during the year for the first time this century, and the total output was also the lowest for at least eight years; but leaving warships out of the account, the British output was greater than that of all foreign countries combined. We only launched warships of 74,186 tons, while the rest of the world launched 235,503 tons. Exports of machinery fell off slightly, but still far exceeded the records of all years this century except 1907.

The average number of members on "unemployed benefit" per month was no less than 11,021, or 10·2 per cent of the total number of members, as compared with 2·9 and 2·8 per cent. in the two preceding years, and 4·4 to 5·6 in the years 1902-5. To find a percentage of unemployed anything like as great we must go back to 1897 (14·8 per cent.)—the year of the great strike.

Speed Indicators.—The Council of the Tramways and Light Railways Association is arranging for a series of tests of speed indicators, and an announcement regarding the same appears among our advertisements to-day.

Alleged Long-Firm Frauds.—At Bolton, on June 11th, Thos. Brook Conway and Robert Bullcock, both of Sheffield, were charged with conspiracy to defraud and obtaining goods by false pretences. The accused traded at 11, Church Wharf, and 4 and 6, Dorset Street, Bolton, under the style of G. Wilson & Co., and the police, it was stated, had seized goods to the value of £138, which had never been paid for, and had had complaints regarding goods of the value of £350. The men, who were arrested at Sheffield, where it was alleged they were carrying on a similar business at 2, William Street, had obtained two dynamos, valued £30 16s., from the Rhodes Motor Co., Manchester. The men were committed for trial.

What is House Refuse?—The Holborn Law and Parliamentary Committee has under consideration a matter of interest to firms who generate electricity. The Birkbeck Bank, Ltd., applied for the removal of certain refuse from their premises in Southampton Buildings, which they claim is house refuse. The contractor, however, asserts that the same is trade refuse, and has rendered an account for its removal. The bank generates electricity and supplies it to the tenants of the numerous offices in the building, and also heats and supplies hot water for lavatories and radiators for heating the offices referred to. The refuse in question is caused in connection with this work.

Electric Cabs in Berlin.—The hopes which were expressed at the meeting in 1907 of the Berlin Elektromobil-Droschken Gesellschaft, foreshadowing the possibility of the payment of a dividend for the next financial year, have not been fulfilled by the details contained in the company's report for 1908. The surplus of receipts over working expenses amounted to £25,040, as compared with £19,090 in 1907. After providing £22,600 for depreciation as against £27,150 in the preceding year, and meeting interest and commission charges, the accounts show a profit of £540 as contrasted with a loss of £5,480 in 1907, so that the debit balance becomes reduced to £12,100. The smaller amount allocated to depreciation mainly applies to the accumulators, but if a similar sum had been appropriated for this purpose as in 1907 no profits would have been indicated for the past year. An explanation of this point is given in the report, which states that as the B batteries withdrawn from the service were written off in 1907, and as the A batteries are maintained by contract, a smaller deduction has been made for depreciation. The cab mileage run during the year amounted to 3,025,891 miles as compared with 2,255,266 miles in 1907. It is mentioned that the unfavourable economic situation still exercises an influence upon traffic undertakings in general, and especially on the cab traffic.

Electrical Cause of a Cape Town Boiler Explosion.—In his annual report, the Chief Inspector of Explosives for Cape Colony refers to the explosion which occurred last year in the railway electrical installation just outside Cape Town Station. A boiler of the locomotive type used in the works exploded, killing two men and causing considerable damage to the building. The explosion was caused by the breaking of the iron stays which support the fire-box, resulting from corrosion. "The question of this explosion," says Mr. Foakes, as reported in the *Cape Times*, "is entirely outside my duties, but from a scientific point of view I took a considerable interest in it, and ventured to suggest that the rapid corrosion was due to electrical causes, and not merely to the action of the water, as suggested at the inquiry. In forming this

opinion, I noticed that the corrosion had taken place at the point where the iron stays had been in contact with the copper roof of the fire-box. At no other portion of the stays was the corrosion manifest. The suggested electrical cause might either be produced by the contact of the two dissimilar metals, or by currents arising or induced in the power station."

Shock Fatalities.—An inquest was held on Tuesday regarding the death of John Pridden, an electrician employed at the "White City," who was engaged in fixing and wiring the motors that work the "Witching Waves." While holding a wire above his head and using pliers with the other hand, he slipped, and his head came into contact with a live terminal. He died shortly afterwards. Leon Freeman, an electrical contractor, said that Pridden removed the covers of the terminals, which he ought to have replaced after the fuses had been extracted. Had he done that, there would have been no accident. The jury returned a verdict of "Accidental death," and expressed the opinion that it was negligent on the part of Mr. Freeman not to see that Pridden was quite safe before he commenced his work.

On Friday last week an inquest was held on the body of Benjamin Cole (37), blast-furnaceman, who died on May 21st on the top of a tramcar belonging to the Wolverhampton District Tramways Co. travelling from Bilston to Sedgley. The inquiry had been adjourned in order that the Coroner might communicate with the Board of Trade, as it had been suggested that the man's death was due to an electric shock. The Coroner read a report he had received from Mr. A. P. Trotter, electrical adviser to the Board of Trade, who stated that a defect in an electrical conductor was found, causing the charging of the standard. In addition, a defect was found in the circuit of the warning red lamps. The conductor of the car said that the deceased had one foot on the standard and his back against a side rail. A passenger who was also riding on the top of the car told witness he had just had a shock. Directly afterwards witness tried the standard, but did not experience a shock. Mr. Foster (for the tramway company) at this point interposed with a statement that it was clear that there was a defect in an electrical conductor, and the unfortunate man's death was no doubt due to that fact. It was only fair to say that the extraordinary position this man occupied in having one foot on the standard and his back or head against the iron rail made the circuit complete and accounted for his death. This particular car had been completely overhauled at the works and sent out on May 4th, and had only made six journeys when the accident happened. There was nothing that ordinary human foresight could have done to prevent it, and he was instructed by the officials of the tramway company that this was the first fatality of this kind in their experience. Mr. R. W. Cramp, manager of the tramway company, said that the wire had parted, for what reason no one could understand. Inspector F. Biddulph, who boarded the car, gave evidence, saying that Coles had hobnails in his boots. Dr. Ballenden, who had made a post-mortem examination, said he could not find any cause of death at all. He had no experience of death from electric shock, but he could see no other cause. The jury returned a verdict that death was due to electric shock.

London Electric Supply Act, 1908, Joint Conference.—We are informed that the following have been appointed to represent the companies on the Consultative Committee formed in connection with the above Conference:—Mr. R. Stewart Bain, London Electric Supply Corporation, Ltd.; Mr. H. R. Beeton, Brompton and Kensington Electricity Supply Co., Ltd., and Chelsea Electricity Supply Co., Ltd.; Mr. J. B. Braithwaite, City of London Electric Lighting Co., Ltd.; Mr. Harrison Cripps, Metropolitan Electric Supply Co., Ltd.; Mr. W. F. Fladgate, Charing Cross, West End and City Electricity Supply Co., Ltd.; Mr. R. Percy Sellon, County of London Electric Supply Co., Ltd.

The Joint Conference, held on 12th inst., resolved to appoint a temporary consultative committee consisting of 12 members, half representing companies and half municipalities, to draw up rules of procedure for the future meetings of the Conference, which will shortly proceed to see whether a suitable scheme can be formulated to be carried out by the local authorities and companies jointly.

Dr. H. Mansfield Robinson, the joint secretary, informs us that the representatives appointed by the local authorities to serve upon the temporary consultative committee of the Joint Conference are: Councillor W. J. Stapleton (Hackney); Councillor H. R. Vorley (Islington); Councillor H. R. Barge (Poplar); Councillor J. E. Harwood (Shoreditch); Councillor E. R. Debenham (St. Marylebone); Councillor H. H. Gordon, L.C.C. (Stepney).

The Electrical Contractors' Association (Inc.).—On Monday the Annual Dinner of the Electrical Contractors' Association took place at the Holborn Restaurant; covers were laid for 134 members and guests, and the chair was occupied by Mr. E. C. Wallis, the President, supported by Mr. W. Finlay, President-Elect; Mr. W. M. Mordey, President I.E.E.; and other well-known members of the electrical and allied professions.

After the loyal toast, Mr. G. Harland-Bowden proposed the "Institution of Electrical Engineers," to which, he said, the Association was indebted for numerous benefits; the Institution Wiring Rules had been generally adopted, and the Council was in consultation with the Board of Trade regarding the Electric Lighting Acts (Amendment) Bill, while the question of registration of workmen was also under consideration. The Institution was doing all it could to raise the standard of the trade, and to encourage research in electrical engineering. Mr. Mordey, who was cordially received, remarked that the interests of the Institution (of which most of those present were probably members) and the Association were largely identical. The former was concerned mainly with the scientific and professional side of the industry, rather than with the commercial side, but they had the same objects at heart. A Committee was sitting to deal with the question of trade abuses and professional conduct, and, following the example of the Institution of Civil Engineers, would probably issue a code of recommendations next session; when occasion arose to alter the articles of association the Institution would, he hoped, take powers to deal effectively with members who failed to act in conformity with the standard of conduct thus set up. Another question that was occupying the attention of the Council was the adoption of less expensive methods of wiring, in order to open up a great field for electrical development that was at present practically untouched. There was much to be said in favour of cheaper methods; their fears in the past had been too great—experience on the Continent proved that this was so—and he hoped that the result would be the extension of electricity to every town and village in the country. The Council was also considering the advisability of requiring candidates for admission to the Institution to undergo a reasonable practical and theoretical examination to prove that they possessed an adequate knowledge of the principles and practice of their profession. British trade, like the Empire, was founded on character; and as long as the nation maintained its high standard it would continue to lead. The electrical trade was depressed at present, but the depression was felt not here alone, but in the United States and Germany also. The electric light was still a luxury in Germany. Competition might be severe, but it was wholesome.

Mr. J. S. Huddlestone proposed "The Electrical Contractors' Association (Incorporated)," pointing out the advantages of mutual support, and the improvement in the standard of work that had taken place since the Association had been formed. It was a fighting Association, and had secured recognition in numerous quarters. In his reply, the President said that though not very old or large, the Association had a good deal to say for itself, and he hoped that all the contractors in the kingdom would join it; they were taking a noble part in the work of civilisation, and their future historian would be able to give a good account of what they had accomplished.

Proposing "The Cable-Makers' and Kindred Associations," Mr. L. G. Tate expressed the thanks of the Association to the Cable-Makers' Association, who went beyond the letter of their agreement, and acted up to the spirit of it, in handing over a rebate that had not been fully earned—practically making a present of £700 or £800 to the contractors. The present slight friction between themselves and the Municipal Electrical Association was based upon a misunderstanding; they had no wish to interfere with the supply of electricity—only with its consumption. Regarding the National Electrical Manufacturerers' Association, he congratulated Messrs. H. H. Berry and Hawes on the great work of reorganisation that they were carrying out, and expressed a hope that when it was completed the two associations would be able to co-operate.

Mr. L. Sawers, in reply, said that the manufacture or "fabrication" of the dielectric of cables was an industry which somewhat resembled the art of cooking; as there was good and bad cooking, so there were good and bad cables. He hoped that the two associations would act together in harmony. Mr. C. Macarthur Butler said that the Council of the M.E.A. would give every attention to any communication from the Contractors' Association. There were good points in the Bill, but he feared it would not pass the second reading. He hoped his Association and the Contractors' Association would, in future, meet on friendly terms. Mr. H. H. Berry said that the Contractors' Association had made wonderful progress during the past year, and he only hoped it would not become too strong for the Manufacturers' Association.

Mr. E. L. Berry proposed "The President and Hon. Officials," remarking that it was a sorrowful occasion for him, as he was leaving them just as they were stepping on to a higher plane. The Council had conferred on him one of the highest honours in their power by making him an honorary member. He expressed the grateful thanks of the Association to Mr. Tweedy Smith (hon. solicitor), the auditors, the indefatigable President, and all the other officials, past and present. Mr. Wallis replied that the work brought its own reward; he did all that he could for them, and would gladly have done more. Mr. Tweedy Smith outlined the history of the Amendment Bill, and remarked that the Lords chose the definition of a contractor that they themselves desired, which shut out the jerry wireman. He believed that, in no long time, they would institute examinations and raise the standard to a very high degree.

A musical entertainment alternated with the toasts, and the proceedings lasted to a late hour.

Magnetic Elements for 1908.—The annual visitation of the Royal Observatory at Greenwich took place on June 5th. In his report, the Astronomer-Royal states that the magnetic elements for 1908 were as follows: Mean declination, 15° 53·5′ West; mean dip, 66° 56′ 17″; mean horizontal force, 1·852s (metric units).

Cricket.—"Robertson" and "Osram" *v.* General Electric Co., Witton.—On Saturday last, June 12th, the annual cricket match between these clubs took place on the large and spacious ground of the former at Mill Hill Park, and ended in a draw. Scores: "G.E.C.," Witton, 75 for 8 wickets (innings declared); "Robertson" and "Osram," 36 for 6 wickets. After the game, both teams dined together at the dining hall at Brook Green Works, and a visit was then made to the "White City" before leaving for Birmingham.

Institution and Lecture Notes.—Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held on the 11th inst., at the Metropolitan Electric Tramways Offices, Manor House, Finsbury Park, N., those attending being:—Mr. Blain (West Ham), chairman; Mr. Ullman (East Ham); Mr. Schofield (Leyton); Mr. Mittelhausen (Bexley Heath); Mr. Howard (Barking); Mr. Hammond (Metropolitan Electric); Mr. Mason (South Metropolitan); and Mr. Goodyer (Croydon), hon. secretary. The last named reported that he had received various communications relating to Metropolitan tramway matters since the last meeting, and, after having read the same, it was decided that several of them should be followed up. The visitors inspected the company's offices, and a special car having been placed at their disposal, they were conveyed to the Wood Green and Finchley depôts, accompanied by Mr. A. H. Pott (the company's chief engineer), and Mr. A. L. Barber (secretary). At both depôts Mr. Pott explained many matters of interest in connection with the working of the system. Twenty-five new bogie cars, with Brush bodies, Mountain & Gibson bogie trucks, and G.E. 67 equipment, were in course of erection at the Finchley depôt, and Mr. Pott kindly pointed out several new features in connection with the same. The members were much pleased with the inside roofing design in the new cars. The party subsequently returned to Finsbury Park, where they were very hospitably entertained on behalf of Mr. James Devonshire, the managing director, who was unavoidably prevented from being present. Mr. Blain, in moving a vote of thanks to Mr. Devonshire, Mr. Pott, Mr. Hammond and Mr. Barber, stated that the members would look forward to having the opportunity, later on, of inspecting the company's extensive repairing works now in course of erection at Hendon.

Institution of Municipal Engineers.—The roll of the Institution is now: Members 556, students 57; total, 613. The application of the Institution for affiliation to the National Association of Local Government Officers has been unanimously acceded to by that body.

Society of Engineers.—On June 16th, by the courtesy of Messrs. Ellington & Woodall, engineers to the London Hydraulic Power Co., a number of the members were enabled to visit the company's new power station, which is in course of construction at Grosvenor Road, Westminster. When completed this building will be the largest of the company's pumping stations, and will replace the existing station at Millbank Street, which has been acquired by the L.C.C. for the Westminster improvement. There are at present about 165 miles of hydraulic power mains laid in London, and served by five central stations from two to three miles apart. The supply is over 20,000,000 gallons per week, with about 6,000 machines at work.

Appointments Vacant.—Instructors in electrical engineering and in electricity and magnetism for Kingston-upon-Thames Technical Institute next winter session. "B" class station supervisor for H.M. Dockyard, Haulbowline, Co. Cork (42s.). Consumers' engineer for the West Hartlepool electricity department (£90). Engineer to take charge of the electrical and other plant for the Rochdale Union Workhouse (50s.). (See "Official Notices" for the foregoing.) A lecturer in civil engineering ($1,500), and demonstrators in physics and chemistry respectively ($1,000), are wanted for the University of Manitoba, Winnipeg. Applications by July 1st to Mr. D. M. Duncan, Registrar.

Blair v. Maidstone Palace of Varieties, Ltd.—Sitting for the disposal of company matters, Mr. Justice Neville had before him on Wednesday last this debenture-holders' action, with reference to a claim by the Electric Light, Power and Hiring Co., Ltd.

Mr. Van Neck, who appeared in support of a summons taken out by the plaintiff in the debenture-holders' action, said that the object was to obtain the disposal of a claim made by the Electric Light Co. against the Receiver of the theatre company. The claim was made against the Receiver for using certain electric plant that was on the premises at the time of his appointment. The theatre had now been sold, and they were in a position to deal with the assets and distribute them, but for this claim. The position taken up by the electric company was that they had six years within which to bring in their claim, and they would bring the matter in when they chose. The Maidstone Palace of Varieties, Ltd., was incorporated in September, 1907, and in September, 1908, the company entered into an agreement with the electric company in the nature of a hire-purchase agreement. In April, 1908, the theatre company issued certain debentures creating a floating charge over the whole of its assets, and on July 24th, 1908, failed to pay one of the instalments under the hire purchase agreement. The Electric Co. commenced an action in the King's Bench Division, claiming payment of the hire for the whole period of five years and for delivery up of the plant. On September 23rd, the debenture-holders' action was commenced, and on September 30th a receiver and manager of the undertaking was appointed. He took possession of the theatre, and carried it on. The Electric Co. had obtained in their King's Bench action the appointment of a Receiver of their plant, but he appeared to have done nothing, and when the debenture-holders' Receiver went in he found the electric plant in use and continued to use it. The Electric Co. obtained judgment in their action, and the electric plant had been given up to them, but they now made a further claim for alleged tortious acts committed by the Receiver. In respect of that, however, they declined to bring in any claim in the debenture-holders' action, and therefore the distribution of the theatre company's assets was hung up. The plaintiffs, therefore, asked that they should be directed to bring in any claim they might have within seven days, and that such claim should stand barred. The claim made now was a claim for the use of the electric fittings, while the Receiver was in possession, and he asked for an injunction to restrain any action being taken against the Receiver.

Mr. David, for the Electric Co., argued that they might have a personal claim against the Receiver for tortious acts done by him, and it was impossible to make that in the debenture-holders' action. He submitted that the Court had no jurisdiction to make any part of the order asked for.

Mr. Van Neck said that the injunction he asked for, was to restrain the Electric Co. from taking proceedings against the Receiver in the event of his distributing the assets in his hands.

In giving judgment, Mr. Justice Neville said that it was alleged that the Receiver had no right to have taken possession of the fittings, and by so doing he had committed a wrong against the hiring company. About that there might be some dispute, but the dispute could be determined in the debenture-holders' action, and there was authority for saying that the Court would not allow its own officers to be subjected to litigation in another court in respect of acts done as its officers. Any claim against the Receiver could be made in the court, and the Court could see that the claimant had justice done him. In his opinion, the Electric Co. had no right to sue the officer of the Court without the sanction of the Court, and he would accordingly grant the injunction asked for, and direct the Electric Co. to bring in any claim they might have in the debenture-holders' action within 14 days. The costs of the summons were reserved until the claim was disposed of.

Annual Outings.—On Saturday, June 12th, the employés of Messrs. E. Brook, Ltd., of Huddersfield, took their sixth annual excursion, making Blackpool their destination. The party was largely indebted to the generosity of the directors, Messrs. E. Brook and G. V. Laycock. Mr. F. Rothwell acted as secretary for the fourth year.

The members of the Social and Athletic Club of the Osram and Robertson Electric Lamp Works will spend their annual outing at Hastings on Saturday, July 3rd.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. C. G. Eley, senior charge engineer in the third class of the Woolwich electricity department, who has been receiving a salary of £140 since April 1st, 1906, has been promoted to the second class, at the maximum salary of that class, viz., £150 per annum. To fill the vacancy caused by the promotion of Mr. Eley, Mr. Robert Scrivener, switchboard attendant, has been promoted to the third class, at the commencing salary of that class, viz., £90 per annum.

The Kettering electricity staff has presented a Gladstone bag to Mr. B. Short, who is leaving to take up a position at St. Albans with the North Metropolitan Electric Power Supply Co., Ltd.

The salary of the Bexhill electrical engineer (Mr. W. T. Le Feuvre) is to be increased from £350 per annum to £425 per annum, by three annual equal increments of £25.

According to the *Australian Mining and Engineering Review*, Mr. A. O. Buckingham has resigned his position as engineer-in-charge of the South Yarra station of the Melbourne Electric Supply Co., and has been succeeded by Mr. A. L. Hargrave, assistant engineer.

General.—The Plymouth Education Committee has appointed Mr. T. N. Riley, of Birmingham, as lecturer in mechanical and electrical engineering at the technical school.

The *Times* states that Prof. H. A. Wilson, F.R.S., Professor of Physics in King's College, London, has accepted the appointment of Professor of Physics in McGill University, Montreal.

The L.C.C. Education Committee is from midsummer, 1909, increasing the salary of Dr. Walmsley, principal of the Northampton Polytechnic Institute, from £800 to £850 per annum, with a further increment of £50 at midsummer 1910, and with increases thenceforward of £50 every two years to £1,000 a year. Dr. Walmsley has been principal of the Institute for 14 years, and by the time he reaches the proposed maximum of £1,000 he will have occupied the position for 19 years.

Mr. W. J. Smith, late Burton and Ashby Light Railway, has been appointed junior assistant engineer to the Scarborough Electric Supply Co.

The staff of Messrs. Willans & Robinson, Rugby, have presented a fumed oak combination desk and bookcase to Mr. Frank Ridgers, who is leaving after 15 years' service with the firm.

Mr. Hammond Hall, late editor of the *Daily Graphic*, has accepted the editorship of "Hazell's Annual," in succession to Mr. Wm. Palmer, who, after 17 years' service, has resigned in order to devote himself entirely to his other work.

The *Australian Mining and Engineering Review* says that Mr. J. M. Jolly, who has spent some months in the works of the General Electricity Co., Berlin, and in visiting mining centres in Europe, investigating the question of electrical equipment of mines, has returned to Melbourne to take up his position as

Victorian manager for Messrs. Staerker & Fischer, agents for the A.E.G.

We understand that Mr. F. Taussig has resigned his position as manager of Ship Carbons, Ltd., in order to start business on his own account, particulars of which will shortly be announced.

NEW COMPANIES REGISTERED.

F. A. Wilkinson & Partners, Ltd. (103,232).—This company was registered on May 26th, with a capital of £500 in £1 shares, to acquire from F. A. Wilkinson the benefit of certain existing inventions for improvements in, and relating to, services for electric heating and wiring for houses and the like, to develop and turn to account the same, and to carry on the business of electricians, electrical, mechanical and general engineers, makers of, and dealers in, electrical apparatus, &c. The subscribers (with one share each) are:—F. A. Wilkinson, Hotel Great Central, Marylebone Road, W., electrical engineer; R. C. Wilkinson, Ashbury Court, Beaworthy, North Devon, gentleman. Private company. The number of directors is not to be more than four: F. A. Wilkinson is the first; qualification, £250; remuneration (except managing director), £190 each per annum. Registered office, 58, Leighton Road, West Ealing.

Eaton Telephone Disinfector Co., Ltd. (103,275).—This company was registered on May 28th, with a capital of £500 in £1 shares, to carry on the business of manufacturers and suppliers of contrivances and appliances for use in connection with telephones, speaking tubes and the like, and other articles capable of being used either chemically or as disinfectants, &c. The subscribers are:—H. Cohen, 36, Jewin Street, E.C., merchant, 50 shares; F. L. Cohen, 36, Jewin Street, E.C., merchant, 25 shares. Private company. The number of directors is not to be less than two or more than five: the first are H. Cohen and F. L. Cohen; qualification, five shares. Registered office, 36, Jewin Street, E.C.

Beam Co. (British Electrical and Mechanical Co.), Ltd. (103,386).—This company was registered on June 8th, with a capital of £1,000 in £1 shares, to take over the business of an electric, telegraph, and general engineer and contractor carried on by A. Lawes at 35, Devonshire Chambers, Bishopsgate Street Without, E.C., as the Beam Co. (British Electrical and Mechanical Co.). The subscribers are:—A. Lawes, 35, Devonshire Chambers, E.C., gentleman, 994 shares; W. J. G. FitzGibbon, The Firs, Shenfield, secretary, 1 share; J. T. Hadley, 27, Furnival Street, E.C., printer, 1 share; P. F. Hadley, 56, Chatsworth Avenue, Wimbledon, printer, 1 share; E. J. Morgan, 247, Wightman Road, Hornsey, N., clerk, 1 share; T. H. Meynell, 3 and 4, Lincoln's Inn, solicitor, 1 share; W. D. FitzGibbon, Fairlight, Borrington Road, Crouch End, N., cashier, 1 share. Private company. The number of directors is not to be less than two or more than five; the first are A. Lawes and W. J. G. FitzGibbon; qualification £50; remuneration, £50 per annum, divisible. Registered office, 35, Devonshire Chambers, Bishopsgate Street Without, E.C.

Grassington Electric Supply Co., Ltd. (103,392).—This company was registered on June 8th, with a capital of £1,000 in £1 shares, to carry on at Grassington and elsewhere in Yorkshire, the business of an electric supply company in all its branches, and to adopt agreements (1) with J. S. Fielden, and (2) with C. Pullan. The subscribers (with one share each) are:—C. Pullan, King's Arcade, Bradford, electrical engineer; J. Crowther, Ridley House, Grassington, chemist; F. Hillman, Market Square, Grassington, estate agent; J. H. Heyworth, Wilson's Arms Hotel, Grassington, hotel keeper; J. S. Fielden, Sheep Street, Skipton, draper; H. Moss, 5, Cavendish Street, Bradford, electrical engineer; H. Briley, High Street, Skipton, clerk. Minimum cash subscription, £100. The provisional directors are C. Pullan, J. Crowther, F. Hillman, J. H. Heyworth, J. S. Fielden, H. Moss, and H. Briley; qualification, £10; remuneration as fixed by the company. Registered office, 51, King's Arcade, Bradford.

Walker Hanna Patent Bearings Co., Ltd. (103,401).—This company was registered on June 8th, with a capital of £2,400 in £1 shares, to acquire the patents and rights granted to R. Walker Hanna relating to improvements in the manufacture of brasses or bushes for the bearings of shafts and axles applicable to railways, tramways, rolling stock, locomotive engines and motors, and to develop and turn to account the same. The subscribers (with one share each) are:—E. M. Knowles, Thicketford House, Bolton, chartered accountant; H. G. Hills, 2, Booth Street, Manchester, engineer. Private company. The number of directors is not to be less than three or more than five; the first are H. G. Hills, R. Walker Hanna and E. M. Knowles; qualification, 100 shares; remuneration as fixed by the company. Registered office, 2, Booth Street, Manchester.

Vaughan Engineering Installations, Ltd. (103,469).—This company was registered on June 11th, with a capital of £5,000 in £1 shares, to acquire the business carried on at 298-300, Goswell Road, London, as Vaughan and Cook, Ltd., together with the under leases of the said premises, to adopt an agreement with W. Briggs, LL.D., and to carry on the business of electric light, gas, hot water and ventilating engineers, electricians, manufacturers of motors, batteries and electroliers, &c. The subscribers (with one share each) are:—W. Briggs, LL.D., Owlbrigg, Chaucer Road, Cambridge; W. R. Briggs, 45, Bedford Square, W.C., engineer. Private company. The number of directors is not to be less than two or more than five; the first are Dr. W. Briggs, W. R. Briggs and T. W. Vaughan; remuneration as fixed by the company. Registered office, 298 and 300, Goswell Road, Finsbury, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dixon & Corbett and R. S. Newall Co., Ltd. (24,228).—This company's annual return, made up to April 2nd, 1909, has been filed. 6,000 ordinary and 1,956 preference shares have been taken up out of a nominal capital of £130,000, in 6,000 ordinary and 6,000 preference shares of £10 each. £17,060 has been received on 1,706 preference, and £63,500 is considered as paid on 6,000 ordinary and 250 preference. Mortgages, £9,000; debentures, £38,800.

Howard Asphalt Troughing Co., Ltd. (69,270).—This company's annual return, made up to March 29th, has been filed. 1,007 ordinary and 1,000 deferred shares have been taken up out of a nominal capital of £20,000, in £1 shares (1,000 deferred). £7 has been received, and £3,000 is considered as paid. Mortgages and charges: Nil. (Originally registered as Howard Conduit Co., Ltd.)

British Prometheus Co., Ltd. (74,889).—Issue on April 22nd of £200 debentures, part of series created October 30th, 1907, to secure £3,500, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Melbourne Electric Supply Co., Ltd. (63,334).—Particulars of £250,000 debenture stock created by resolutions of various dates from September 16th, 1901, to May 4th, 1909, and secured by various trust deeds; filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100,000. Property charged: Freehold properties in Australia and the company's general assets, excluding uncalled capital. Trustees: Debenture Corporation, Ltd.

Mawdsley's Ltd.—Particulars of £2,000 second debentures, created April 26th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,200. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Hastings and District Electric Tramways, Ltd. (82,521).—This company's annual return was filed on April 2nd, when 40,000 preference and 28,235 ordinary shares had been taken up out of a nominal capital of £500,000 in 50,000 preference and 50,000 ordinary shares of £5 each. £200,000 has been paid on 40,000 preference and £141,175 is considered as paid on 28,235 ordinary. Mortgages and charges: £250,000.

Musselburgh and District Electric Light and Traction Co., Ltd. (85,169).—Particulars of £90,000 debentures created by resolutions of November 13th, 1905, and April 8th, 1909, and secured by trust-deeds dated November 13th, 1905, and May 11th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £90,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: Sir Nathaniel Nathan and M. R. Pryor.

London Platino Brazilian Telegraph Co., Ltd. (12,093).—This company's annual return was filed on May 18th, when 37,480 shares had been taken up out of a nominal capital of £400,000 in £10 shares. £374,800 is considered as paid. Mortgages and charges: Nil.

Reliance Works Co., Ltd. (81,358).—Particulars of £2,000 debentures created June 25th, 1907, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Electro-Mechanical Brake Co., Ltd. (98,276).—Two mortgages dated April 27th and May 4th, 1909, to secure £250 and £350 respectively, charged on (a) moneys due or to become due to the company from the Midland Engineering Co., Ltd., and (b) moneys due or to become due to the company from the Birmingham Corporation Tramways. Holders: Metropolitan Bank (of England and Wales), Ltd., Gracechurch Street, E.C.

Further charge on freehold property at West Bromwich, dated May 19th, 1909, to secure all moneys due, or to become due, from the company to the Metropolitan Bank (of England and Wales), Ltd., up to £1,600.

Folkestone Electricity Supply Co., Ltd. (51,825).—Particulars of debenture stock not exceeding the nominal amount of the issued share capital, authorised by resolutions of various dates from April, 1900, to March, 1909, and secured by trust deed dated June 14th, 1900, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: Land, station, engine rooms, offices, and other premises at Folkestone. Trustees: G. Stungen and W. R. Davies. Also debentures for £10,000, dated April 28th, 1909, to further secure the debenture stock, charged on the company's undertaking and property, present and future.

Bombay Electric Supply and Tramways Co., Ltd. (85,055).—Particulars of £150,000 debentures created May 11th, 1909, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Concession from Municipality of Bombay, the Bombay Electric Licence, 1905, and Electric Traction Licence, 1907, and the company's undertaking and other assets, present and future. Trustees: Electric and General Investment Co., Ltd.

Omega Electric Lamp Co., Ltd. (100,678).—Issue on May 14th of £500 debentures, part of a series of which particulars have already been filed.

Chelsea Electricity Supply Co., Ltd. (20,468).—This company's annual return, made up to March 24th, has been filed. 49,436 ordinary and 6,000 preference shares have been taken up out of a nominal capital of £400,000 in 74,000 ordinary and 6,000 preference shares of £5 each. £5 per share has been called up on 37,770 ordinary and 6,000 preference shares, resulting in the receipt of £218,850; £68,330 is considered as paid on 11,666 ordinary. Mortgages and charges: £175,000 debenture stock.

Brush Electrical Engineering Co., Ltd.—A memorandum of satisfaction in full, by instalments from November 14th, 1901, to September 9th, 1908, of charges dated April 15th, 1901, to June 30th, 1908, securing in all £103,297 13s. 1d., has been filed. (Registered May 21st, 1909.)

Lowden Electric Lamp Co., Ltd. (83,470).—F. Geoghan, F.C.A., ceased to act as receiver or manager on May 25th, 1909.

Electrical Contracts and Maintenance Co., Ltd. (101,757).—Particulars of £1,000 debentures created April 23rd, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

British Aluminium Co., Ltd. (41,104).—Particulars of £1,100,000 debenture stock created by resolutions of July 3rd, 1908, and May 4th, 1909, and secured by trust deeds dated July 28th, 1908, and May 4th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation Act, 1908, the amount of the present issue being £100,000. Property charged: Company's freehold and leasehold property and other assets, present and future, except uncalled capital. Trustees: Trustees, Executors and Securities Insurance Corporation, Ltd.

British Tungsten Lamp Co., Ltd. (100,468).—Particulars of £4,000 debentures created April 22nd, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, excluding uncalled capital. No trustees.

CITY NOTES.

German Transmarine Electricity Co.

The Deutsch-Ueberseeische Elektrizitäts Gesellschaft, of Berlin, is the most important German oversea undertaking of its kind from a financial point of view, and is not approached by any similar foreign enterprise maintained by any other country in the world. It is specially interested in the supply of light and power in South American cities and in tramways in the same region. According to the directors' report for 1908, the working surplus earned by the electricity works increased by £84,000, as compared with the preceding year, but the interest payments on the bonds advanced by £70,000. The accounts show the undernoted figures for the two years:—

	1908.	1907.
Share capital	£3,600,000	£3,600,000
Bond capital	2,750,000	1,500,000
Gross profits	753,890	660,300
Interest on loans	128,700	58,000
Depreciation provision ...	104,400	109,900
Net profits	390,570	386,700
Dividend	342,000	342,000
Dividend, per cent.	9½	9½

Since the beginning of the present year, the ordinary share capital has been raised to £4 000,000 by the issue of £400,000 in additional shares, whilst a fresh emission of £750,000 in 5 per cent. bonds has increased this class of capital to £3,500,000, the total of the two being £7,500,000. A large portion of the capital augmentations in the past few years naturally relates to participations in other enterprises. Thus, in the case of the Chilian Electric Tramway and Light Co., the report shows that the company holds £650,000 in 6 per cent. preferred shares and £386,000 out of the total of £500,000 in ordinary shares, whilst the advances made to the Chilian company are returned at £350,000, as compared with £233,000 in 1907. The Transmarine Co. now possesses the whole of the share capital (£250,000) in the Valparaiso Electric Tramway Co. and has also advanced to the latter £658,000, as against £464,000 in 1907, whilst considerable interests are held in the Transatlantica of Monte Video, to which important loans have likewise been made in connection with the conversion of the tramways to electric traction, which was completed by the end of 1908.

The report, in referring to the company's generating stations at Buenos Ayres, states that the supply of current increased from 76·30 million KW.-hours in 1907 to 86·34 millions in 1907, and the connections advanced by 14,135 KW. to a total of 68,950 KW. In addition the tramways served by the company, which had a daily average of 1,425 cars in operation, received 12,600 KW. as contrasted with 10,000 KW. in 1907. The capacity of the central stations at the end of 1908 was 38,470 KW., and on the completion of the extensions at the Boca station and of the large new stations at Avellaneda the aggregate capacity of the electricity works will be 75,970 KW. The company's reserve fund stands at £316,500, and the contingency fund at £242,500.

Anglo-Portuguese Telephone Co.

MR. HERBERT ALLEN (chairman) presided on Monday, at the Cannon Street Hotel, E.C., over the twenty-second ordinary general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, June 11th, page 976), the CHAIRMAN said that during the year under review the political, commercial, and financial conditions in Portugal were somewhat disturbed, and the prolonged drought from which the country had suffered had naturally had an adverse effect upon the trade and the community there. In consequence of this the increase in the business during the year was not so marked as in some previous years, but still it was a most successful year on the whole, and it seemed to be in the nature of a well-conducted telephone enterprise that it should thrive in the face of all obstacles. The profit and loss account showed a gross revenue of £42,048, an increase of £2 353 on the previous year. The total expenses, including royalties, were £23,840, an increase of £1,230. Included in the revenue expenditure there was a sum of no less than £14,376 for maintenance, so that it could not be said that they favoured their revenue account at the expense of capital. Their expenses included an item which was probably unique in the case of telephone companies, viz., the provision by insurance against earthquakes and their consequencies. Some of their friends rather smiled when they told them two years ago that they contemplated this earthquake insurance, but several times since when he had opened his morning paper he had been glad that they had done so. Their net profit on the year's operations was £18,208, against £17,085, which was an increase of £1,123. This was quite a modest achievement in comparison with the increases in 1907 and 1906, but it was explained by the fact that the capital expenditure was not immediately productive. In the balance-sheet a new item was the exchange fluctuations account of £9,500. The most dangerous element in their business was the cause of the exchange, which at times was subject to severe fluctuations. The highest rate in 1908 was 48d. per milreis, and the lowest 41·78d. Every 1d. difference made a difference to them of £500 a year. The average rate during the year was 46·16d., but the average rate at which the company effected it remittances was 49⅛d. They had taken steps to insure against a fall for the next 12 or 18 months. Sundry creditors were £10,184, against £7,182, and the increase was due to the heavy capital expenditure. Since the close of the accounts, however, they had reduced the account to about £6,000, without having to touch any of their investments. The reserve fund would, with the sum to be voted that day, stand at £20,000. Capital expenditure was an important feature in the balance-sheet. Last year it was £13,636, against £8,778 in 1907, and £8,529 in 1906. More than half that expenditure was due to the further substitution of underground cables for overhead wires, and to additions to the switchboard in the central exchange at Lisbon, and as the outcome of which their effective working capacity was nearly doubled. The effect of this heavy outlay would make itself more apparent this year. It was now rather more than four years since he joined the board, and he had interested himself that morning in glancing over the report of his maiden speech to the shareholders, and in taking a survey of what had happened since. For some years before 1904, they paid dividends of 3 per cent.; and in 1904 they paid 5 per cent. on a capital of £57,000. This year they paid 8 per cent. on a capital of £100,000. In 1904 they had a floating debt of about £45,000, carrying 6 and 8 per cent. interest, and now they had £50,000 of 30 years debenture stock bearing 5 per cent. interest, and quoted on the market at a premium. In the meantime they had spent £30,000 on capital account, and had cash at the bank of over £13,000. Their gross income in 1904 was £25,962, as against £42,048 this year; the gross profit £10,796, as against £18,208, while the net profit in 1904 was £8,360, against £14,075 this year. In 14 years they had distributed dividends of 5, 6, 8 and 8 per cent., and a bonus of 33 per cent. They had also placed £20,000 to reserve, redeemed over £3,500 debenture stock, established an exchange reserve investment account of £3,500, and maintained the concern at the highest standard of efficiency, whilst making ample provision for depreciation. He would be surprised if the present year did not establish a fresh record both in income and profits.

MR. J. E. KINGSBURY seconded the motion, and it was carried.

India-Rubber, Gutta-Percha and Telegraph Works, Ltd.

MAJOR LEONARD DARWIN presided on Tuesday, at the offices, 106, Cannon Street, E.C., over the half-yearly general meeting of the above company.

The CHAIRMAN said it was the custom of the company to call the shareholders together at that period to obtain their sanction to the payment of an interim dividend, as there were no accounts submitted for consideration. On the present occasion there was a new phase in the meeting in so far as the holders of the recently-issued preference shares were called together with the holders of the ordinary shares. The preference dividend recommended for payment was not exactly half of the 5 per cent. per annum to which the preference shareholders were entitled, but this was explained by the fact that it had been calculated on the period from which the instalments were paid. Since he last addressed them six months ago a considerable change had taken place in the market for raw material. In December last the price of fine Para rubber was 5s. 0½d. per lb., now the quotations were about 6s. per lb., and the medium grades had also advanced in sympathy. To protect themselves, in common with the principal manufacturers, they had advanced the selling prices of their general goods, and would doubtless have to advance the price of their special goods as contracts fell in for renewal. It was unfortunate that the last quarter of the financial year should have had this advance in selling prices to face, as it would to some extent diminish their sales during the period and lessen the substantial percentage increase in the sales which they had experienced during the three quarters just terminating. The Palmer Cord Tire and the Persan tire continued to give satisfaction to motor-car owners, their well-recognised merits outweighing, in the opinion of owners, an initial cost which was greater than that of any other motor tire on the English and French market. Some twenty years ago they introduced, in conjunction with Messrs. Harland & Wolff, india-rubber tiling for the trans-Atlantic liners which that firm was constructing, and this flooring proved so successful that it was adopted for use in some of the large buildings in the city of New York. Some of the large buildings in London had also adopted it on account of its silent tread and cleanliness. They were now introducing a mosaic rubber tiling which had an excellent appearance and lent itself to surroundings. This mosaic tiling should, they thought, find acceptance by architects and others. At a former meeting he mentioned that they had completed the electric installation of the town of Dumfries under a provisional order granted by the Board of Trade. He had now further to state that the negotiations were all but completed for the transfer of this undertaking to a company, but some time must necessarily elapse before they could realise their investment in this work. He proposed "That the distribution of a dividend of 5s. 4d. per share, or at the rate of 5 per cent. per annum, payable on the 1st prox. to the shareholders on the company's register of preference shares at that date, be approved and sanctioned," and "That the distribution of an interim dividend of 2½ per cent., or 5s. per share, payable, free of income-tax, on the 17th inst., to shareholders on the company's register of ordinary shares, be approved and sanctioned."

MR. C. H. MOORE seconded the motion, which was adopted without discussion.

The CHAIRMAN announced that the board had unanimously elected Mr. Mathew Hamilton Gray, Mr. Christian H. Gray, and Mr. W. E. Gray extraordinary directors of the company. These gentlemen had been closely identified with the management of the business for years, and its success had largely depended on their admirable qualities. Mr. Mathew Gray had expressed regret that he felt unable to give the close attention to the business he would like, and he hoped the board would accept his services in a consulting capacity instead of as an extraordinary director, and to this they had agreed.

Winnipeg Electric Railway Co.—The directors announce a quarterly dividend of 2½ per cent. on the capital stock.

Oriental Telephone and Electric Co., Ltd.—The registers of transfers of 4 per cent. and 4½ per cent. redeemable debenture stock will be closed from June 17th to 30th, both days inclusive, for the preparation of warrants for the half-yearly interest due on July 1st.

United Electric Tramways of Monte Video, Ltd.

The fifth ordinary general meeting of this company was held on Tuesday at Winchester House, E.C., Mr. George A. Touche presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, June 11th, p. 974), said there was nothing in the accounts which ought to make the shareholders discontented. At the extraordinary meeting held some time ago, he warned them that notwithstanding the expansion in traffics, caused by the conversion to electric traction—and the expansion had been satisfactory, because at times it had been difficult to cope with the traffic—it would be a mistake to carry away any exaggerated ideas about profits. He pointed out that the period of transition had not yet ended, and that while they were still without the full benefits of electric traction, the accounts would have to bear an even heavier proportion of debenture interest, representing the cost of conversion, than in the previous year. Bearing that qualification in mind, the directors considered that the results now submitted, were as satisfactory as could reasonably be expected. In the present stage of development the proprietors had to consider not so much the precise amount available for distribution, as the measure of progress which had been made in securing the support of the travelling public through the improved facilities they were able to offer. On that question the most illuminating figures were those relating to the mileage in operation, passengers carried and gross receipts. At the present time they had 80 miles of single track in operation under electric traction, and in due course that would be increased to about 84 miles by the extension to Colon, which branch was not yet in service owing to the need for an underground crossing under the Central Uruguayan Railway. At the end of last year they had 77½ miles open, but the average during the year was slightly under 60 miles, while for the first part of the year—to April, 1908, which included the summer season, when the best traffics were obtained, they had less than 50 miles under electric traction in operation. The chief reason for that was that a great part of the Union line, representing about 22 miles, only came under electrical operation at the end of July, 1908, so they had only been running that important section of the line electrically for a little over three months. In addition to that the climatic conditions of Monte Video for once forgot to be favourable; otherwise the results would have been considerably better. Having regard to all those circumstances, he thought they had no reason to be displeased either with the traffic receipts or with the number of passengers carried. The traffic receipts amounted to £232,738, representing an increase of 17 per cent. over the receipts of the previous year and an increase of 79 per cent. over the year 1906, when the lines were operated by animal traction. The passengers carried were 25,901,439, showing an increase of 21 per cent. over those of the previous year, and of 87 per cent. over 1906. The percentage of operating expenses to gross receipts had been reduced from 66½ per cent. in the year 1906-7, when there was a mixed service operating, to practically 64 per cent., a decrease of 2·15 per cent.; but going back to 1906, when the lines were operated by animal traction, the decrease was nearly 10 per cent. The increase in the gross receipts over 1906 was 79 per cent, whereas the increase in the net receipts was 146 per cent. He looked for a reduction of last year's rate of 64 per cent., when they got the full benefit of electrification. Even under the unfavourable conditions which prevailed last year, while the gross receipts increased 17 per cent., the net receipts increased 24 per cent., the net being £83,587, of which £9,333 was from animal traction, against £67,194 in the previous year, of which £20,986 came from animal traction, which gave them a net increase of £16,393. The figures for the current year were now available, and they showed that the increases had been continuous. The figures for the six months to April 30th, 1909, were distinctly encouraging, the gross receipts having amounted to £137,982 against £126,778 in the corresponding half of last year, an increase of £11,204, and the net receipts had amounted to £61,675 against £52,507—an increase of £9,168—that meant an increase of over 17½ per cent. in the last six months as compared with the same period last year. As regarded passengers carried for the half-year to April 30th, 1907, they numbered 10,969,092, for the half-year ended April 30th, 1908, 13,525,000, and for the six months to April, 1909, 15,371,000, or, roughly, 50 times the population of Monte Video, had been carried during the last half-year, while for the complete year under review the figures worked out that each inhabitant had taken about 80 trips. Some time ago he was rash enough to estimate that when the electrical system was complete the gross earnings would amount to £255,000 per annum. Last year they came to £232,738. In the first six months of the current year they had had an increase of £11,204, and May showed a further increase of £2,756, making the total increase to date £13,960. If they added that to last year's figures, they got a total of £246,698, or within £8,300 of the estimate for the whole year, and they still had five months of the year to run. He did not say they were going to make up that figure during the current year, as the remaining part of the year was not the best, but it was satisfactory to note that the traffics were beginning to spread themselves better every year, and the promises of expansion were excellent. Having paid a tribute to Senor Cat, the company's manager at Monte Video, the chairman said they were increasing their power plant and adding to the feeder system. They had no reason to complain of the action of any section of the community—they received fair treatment and no privilege, which he thought was the best foundation for a business structure of stability. There had been further capital expenditure during the past year of £161 385. The increase of capital was £237,881, so it would appear that they had raised £76,000 more than they had spent, but they had £89,000 in hand available for future expenditure. Including the balance brought forward, the directors had a total of £61,432 to deal with. They had written off £1,163 in connection with issues and official quotations of shares and the expenses of increasing the share capital and debenture stock; £2,100 had been set aside for the purpose of the debenture stock sinking fund, and £10,000 had been transferred to a renewals and contingency account. An interim dividend at the rate of 6 per cent. had been paid on the preference shares, absorbing £10,042, and a further dividend of the same amount for the last half-year was now recommended, which would absorb £11,047. Out of the balance it was proposed to pay a dividend of 5 per cent. on the ordinary shares, which would require £15,960, and leave £11,118 to be carried forward. The question of paying an interim dividend to the ordinary shareholders was now under the consideration of the board. In conclusion, Mr. Touche said he wished to take that opportunity of publicly acknowledging the satisfactory manner in which the contractors—Messrs. J. G. White & Co.—had carried out their work.

Mr. H. F. Gunning seconded the motion, and the report was adopted.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Friday, June 18th.—Winnipeg Electric Railway Co.—Scrip, fully paid, for £300,000 4½ per cent. perpetual consolidated debenture stock.

Monday, June 21st.—Anglo-Argentine Tramways Co., Ltd.—169,406 5 per cent. cumulative third preference shares of £5 each, fully paid, Nos. 1,380,008 to 1,549,413.

Thursday, June 24th.—Java Rubber Plantations, Ltd.—6,000 vendors' share of £1 each, fully paid, Nos. 1 to 6,000.

Jugra Land and Rubber Estates, Ltd.—28,000 vendors' shares of £1 each, fully paid, Nos. 122,001 to 150,000.

Kapar (Para) Rubber Estates Co., Ltd.—23,000 vendors' shares of £1 each, fully paid, Nos. 1 to 23,000.

Wednesday, June 30th.—Kapar (Para) Rubber Estates Co., Ltd.—Further issue of 15,000 shares of £1 each, 10s. paid, Nos. 50,001 to 65,000.

And ordered the undermentioned securities to be quoted in the Official List:—

Anglo-Argentine Tramways Co., Ltd.—169,406 5 per cent. cumulative third preference shares of £5 each, fully paid, Nos. 1,380,008 to 1,549,413.

Mexico Tramways Co.—Further issue of $4,825,200 common stock in share of $100 each.

Winnipeg Electric Railway Co.—Scrip, fully paid, for £300,000 4½ per cent. perpetual consolidated debenture stock.

Schmidt's Superheating Co.—The report for the year ended March 31st, says the *Times*, shows a profit of £23,089, and, with the amount brought forward, there is an available balance of £23,244. The directors recommend a further dividend of 10 per cent. on the ordinary shares, making 25 per cent. for the year, transferring to reserve £4,000, and leaving £1,201 to carry forward. Dr. Schmidt has recently taken out patents in connection with steam boilers working at very high pressure, and he is prepared to transfer the same to the company and to commute his present agreement of 20 per cent. on the net profits for the issue to him of 25,000 ordinary shares, bringing the total share capital from £75,000 up to £100,000.

Prospectuses.—*Butte Electric and Power Co.*—There is being offered on behalf of this company until to-day, 18th inst., a further issue of $1,650,000 5 per cent. first mortgage gold bonds, at 97½ per cent.

The Northern Light, Power and Coal Co., Ltd.—The list was to close on Saturday last in an issue of $2,000,000 5 per cent. first mortgage 20-year gold bonds offered by Lloyd's Bank.

Globe Telegraph and Trust Co., Ltd.—The directors report that for the year ended May 31st, 1909, the net revenue, after deduction of expenses, amounts to £207,347, and makes, with the balance of £27,206 brought forward, a total of £234,554. From this amount there has been distributed £131,769 in interim dividends, leaving an available balance of £102,784. The directors now recommend the following final dividends—viz., 3s. per share, less income-tax, on the preference shares, making, with previous distributions, a total dividend for the year on those shares at the rate of 6 per cent. per annum, less income-tax, and 5s. 6d. per share net on the ordinary shares, making, with previous distributions, a dividend on these shares at the rate of 5¾ per cent. net for the year. These dividends will absorb the sum of £75,479, and leave a balance of £27,305 to be carried forward.

Germany.—The Elektrizitäts Gesellschaft (W. Lahmeyer and Co.), of Frankfort-am-Main, reports a net profit of £75,310 for the last financial year, as compared with £80,077 in the preceding 12 months. A dividend of 6 per cent. is being declared.

Belgium.—La Compagnie Auxiliare d'Entreprises Electriques is the title of a new company which has just been formed in Brussels, with a capital of £400,000. Several large Belgian electrical companies and banking concerns are interested in the new undertaking.

La Société de l'Electricité du Pays de Liége, of Sclessin-Ougrée, is increasing its capital to £120,000.

Egypt.—La Compagnie Egyptienne Thomson-Houston, of Cairo, is declaring a dividend of 5 per cent. for the last financial year.

Shawinigan Water and Power Co.—A dividend of 1 per cent. on the capital stock for the quarter to June 30th is payable on July 20th.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	May 31	..	..	52	70,744	— 384	..	..
†Ayr	June 5	316	+ 20	3	829	— 81	8	..
Bath	,, 9	1,850	— 76	23	15,970	+ 573	..	..
Belfast	,, 11	7,767	+ 273	10	39,737	+ 218	37	..
Birkenhead	,, 13	2,274	— 72	10	11,229	— 353	13·52	..
Birmingham Corp.	,, 5	14,186	+1,141	10	63,197	+ 1,629	..	..
Blackburn	,, 9	2,418	— 255	10½	12,720	— 164	13·97	..
Blackpool-Fleetw'd	,, 12	2,240	+ 325	23	92,387	+ 1,021	..	..
Bolton	,, 13	4,843	— 29	11	25,681	— 126	26	..
Bournemouth ..	,, 9	3,660	+ 98	10	17,070	+ 292	21·96	..
Bradford	,, 5	10,811	+1,168	10	47,218	+ 1,912	54·9	..
Brighton	,, 13	2,140	— 9	11	10,036	+ 735	9·5	..
Bristol	,, 11	12,521	— 225	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 4	457	— 8	22	4,758	— 86	3·65	..
Barnsley	,, 4	393	+ 38	,,	8,690	— 60	..	..
Barrow	,, 4	525	+ 37	,,	4,666	— 258	5·37	..
Cavehill	,, 4	208	— 11	,,	1,588	— 177	..	..
Devonport ..	,, 4	800	— 145	,,	8,114	— 1,438	8·85	..
Gateshead ..	,, 4	2,159	+ 187	,,	21,665	+ 89	11·25	..
Gravesend ..	,, 4	520	+ 90	,,	4,212	— 56	6·5	..
Greenock	,, 4	1,205	+ 42	,,	10,921	+ 68	7·25	..
Hartlepool ..	,, 4	590	+ 78	,,	4,664	— 80	6·72	..
Kidderminster ..	,, 4	337	+ 128	,,	2,051	+ 68	..	..
Leamington ..	,, 4	452	+ 96	,,	3,436	+ 304	..	..
Merthyr	,, 4	508	+ 74	,,	4,584	+ 79	2·9	..
Metropolitan ..	,, 4	15,246	+2,581	,,	128,277	+14,561	22	..
Middleton	,, 4	816	+ 37	,,	7,016	— 258	8·5	..
Mid. Joint Com'tee	,, 4	13,714	+1,580	,,	121,279	— 761	..	..
Oldham—Ashton	,, 4	1,235	+ 16	,,	12,060	— 742	9·18	..
Peterborough ..	,, 4	301	+ 39	,,	2,359	— 100	5·31	..
Potteries	,, 4	3,931	+ 50	,,	38,839	— 823	29	..
Rothesay	,, 4	206	— 26	,,	1,980	— 45	2·75	..
Southport	,, 4	762	+ 80	,,	5,606	+ 153	8·17	..
S. Metropolitan ..	,, 4	2,153	+ 235	,,	16,315	+ 469	..	..
Swansea	,, 4	2,349	+ 446	,,	20,072	+ 891	12·5	..
Tynemouth	,, 4	674	+ 243	,,	3,632	+ 164	3·75	..
Weston-s-Mare ..	,, 4	488	+ 290	,,	1,584	+ 442	3	..
‡Worcester	,, 4	697	+ 119	,,	5,605	+ 112	5·75	..
Wrexham	,, 4	219	+ 16	,,	2,076	— 42	..	..
Yorks. Wool. Dist.	,, 4	2,155	+ 278	,,	19,314	— 203	17	..
Miscellaneous ..	,, 4	503	+ 93	,,	4,231	— 93	..	..
Burnley	,, 12	2,630	— 65	..	..	..	..	..
Burton-on-Trent ..	,, 13	562	— 57	11	2,820	— 63	6·62	..
Bury	,, 13	2,652	+ 115	10½	12,990	— 89	22·6	..
†Cardiff	,, 5	2,591	+ 349	10	20,765	+ 387	..	..
Carlisle	,, 12	347	— 42	23	3,573	— 84	..	..
Chatham and Dist.	,, 10	1,973	— 28	23	17,526	+ 1,327	14·98	·61
Cork	,, 10	998	— 53	23	8,998	— 931	..	..
Croydon	,, 4	3,538	+ 397	..	14,407	+ 480	11·25	4·75
Darlington	,, 12	383	— 40	11	2,041	— 141	..	..
Darwen	,, 11	502	— 63	10	2,653	— 98	4·36	..
Dover	,, 5	477	— 70	10	1,918	— 62	4·75	..
Dublin	,, 11	11,698	— 385	..	117,268	+ 686	54·25	..
Dundee	,, 9	2,478	— 51	3½	4,268	— 236	15	..
East Ham	,, 12	2,100	+ 89	10½	10,749	+ 1,692	8·43	·68
Exeter	,, 11	981	+ 132	11	3,860	+ 585	5·5	..
Glasgow	,, 12	35,842	+ 77	..	31,407	+ 1,312	90·5	1·5
Hastings	,, 10	2,341	— 28	..	..	..	..	..
†Huddersfield ..	May 15	1,557	— 29	6	10,829	+ 469	..	..
Hull	June 12	5,019	— 43	10	26,037	+ 114	18	..
Ilkeston	,, 9	289	— 47	10	1,526	— 140	..	..
Ipswich	,, 12	909	— 82	11	4,048	+ 24	10·5	..
Kilmarnock	,, 5	298	+ 2	3	455	— 54	4·25	..
Lan'kshire Trm.Co.	,, 10	2,509	— 167	23	27,765	— 1,750	17·62	1·12
Lancashire United	,, 9	2,915	— 7	23	29 055	+ 114	..	..
Leeds	,, 5	14,787	+1,203	10	64,569	+ 3,614	96·75	·25
Leicester	,, 12	4,688	— 489	..	..	..	..	..
Leith	,, 5	1,189	+ 186	3	1,914	+ 183	6	..
Liverpool	,, 5	22 365	— 132	23	234,055	— 1,458	104	..
‡L.C.C.	May 29	72,081	+1,269	..	302,299	+21,120	121	4·25
London United ..	June 12	15,314	—3,506	..	131,357	—10,887	..	..
Lowestoft	,, 12	425	— 43	37	5,855	— 568	..	..
Manchester	,, 12	31,911	—1,054	11	159,376	— 459	90·5	6
Newcastle	,, 12	3,653	— 276	10	40,811	+ 497	..	..
Newport	,, 5	1,499	+ 143	10	6,668	+ 177	14·5	..
Oldham	,, 13	3,801	— 180	11	22,269	— 1,043	23·75	..
Pontypridd	,, 12	982	+ 166	10½	4,672	— 223	5·5	1·75
Portsmouth ..	..	..	..	..	..	..	14·5	..
Preston	,, 9	1,720	— 57	..	..	..	..	..
Rotherham	,, 10	1,351	— 102	10	6,474	— 194	10	·66
Salford	,, 7	10,611	+ 246	99	..	..	..	..
Sheffield	,, 13	11,778	— 611	11½	64,636	— 1,171	87	1·25
Southampton ..	,, 9	2,287	— 581	10	10,531	— 322	..	..
†Southend-on-Sea ..	,, 9	451	— 148	10	4,687	— 787	..	..
South Shields ..	,, 12	1,194	+ 4	10⅔	5,805	+ 180	..	..
Swindon	May 26	255	— 85	..	..	..	..	..
Tyneside	June 9	970	+ 81	23	9,374	+ 719	..	..
Wallasey	,, 12	2,018	+ 27	10½	9,896	+ 426	..	·22
Walthamstow ..	,, 12	1,525	— 202	11	7,201	+ 299	9	..
West Ham	,, 3	5,408	+ 861	9	23,175	+ 2,951	15	·3
Wolverhampton ..	,, 9	2,008	— 178	10	8,329	— 526	12·5	..
Baker St.-Waterloo	,, 12	6,790	+ 790	23	76 930	+ 6,736	4·25	..
Cen. London Ry...	,, 12	11,810	—1,939	23	127,503	—13,970	6·22	·55
Char. +, Mus. Hamp.	,, 12	3,315	+1,075	23	29,340	+14,740	7.75	..
City & S. Lon. Rly.	,, 13	6,449	+ 186	23	74,696	+ 1,194	7·3	..
Dublin-Lucan Rly.	,, 11	360	+ 96	23	2,960	+ 267	7	..
G.N. and City Rly.	,, 12	2,701	— 396	23	34,662	— 4,185	3·5	..
G.N., P'y. & Brmm.	,, 12	11,685	+ 965	23	133,235	+ 3,665	9·25	..
L'pool Overh'd Rly.	,, 13	3,382	— 137	23	31,443	+ 2,959	6·3	4·8
†Llandudno-Col. Bay	,, 4	569	+ 443	27	4,213	+ 1,333	..	..
Mersey Railway ..	,, 12	4,190	— 194	23	45,455	+ 1,440	4·5	..
Metropolitan Ry...	,, 13	24,779	+1,656	23	267,344	+12,185	24·5	..
Met. District Rly...	,, 12	20,896	+2,626	23	226,340	+21,205	24	..
Anglo-Argentine ..	,, 10	77,597	+4,618	23	905,484	+49,109	..	..
‡Auckland	May 21	15,128	+1,787	20	68,888	+ 8,664	29·3	3·1
Bombay (B.E.T.) ..	,, 19	5,208	+ 213	19	48,909	+ 5,280	..	..
‡Brisbane	May	16,551	+1,008	..	..	..	..	..
Calcutta	June 12	6,441	+ 140	..	..	..	..	..
‡CapeElectricT.Ld.	..	..	..	..	..	..	..	..
‡Kalgoorlie, W.A...	May	3,745	..	..	18,631	..	20·5	..
Madras	May 31	1,074	— 135	21	12,072	— 20	..	..
‡Melbourne	..	..	..	..	..	..	..	..
‡Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.) ..	June 11	2,720	+ 97	23	33,303	+ 14	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

With the end of the half-year near at hand, the money market is slightly stiffening, with the result that for investment securities the demand is none too brisk. A setback in Kaffirs contributed to markets becoming somewhat uneasy, and the general effect of conditions is that business has diminished considerably. After the rush of the previous four weeks, it is a relief not wholly unwelcome, especially as the Stock Exchange has quite settled in its own mind that buoyancy will return before the June half-year is completed.

For the usually dormant Home Railway market to give indication of vitality is so much of a novelty that the upward movement in that department may be described as the chief feature of the moment. The better feeling has circled round to the older Undergrounds, though at present it has not touched Central Londons or City and South London, both of which show declines in their Ordinary stocks. Metropolitan Consolidated, however, has advanced $\frac{3}{8}$, and Districts are $\frac{3}{8}$ up, while Bakerloo 4 per cent. Debenture has crept up to 98, which is only two points lower than the 4 per cent. Debenture stock of the City and South London. Great Northern and Piccadilly Debenture is firm at 95, while Charing Cross Debenture remains at 93.

Great Northern and City Preferred shares are half-a-crown better at 15s. middle. East London Ordinary has ranged between 4½ and 4; it seems rather anomalous that the "D" Debenture stock should have changed hands at 4½ on Monday. Underground Electric Railway issues are creeping up steadily. Power House 4 per cent. Debenture stock is being offered privately in the market at 98, free of stamp and fee. The security appears to be well covered by the lines which take the current from the Power House, but the vendors of the stock are not particularly modest in the price they ask for it. The question naturally arises as to why the stock is not offered to the public in the ordinary way, and the only reply is that no doubt the sellers think they can do better by peddling it out in a manner more private than the issue of a prospectus affords.

Telegraph stocks have been distinctly flat on the Press Conference demand for cheaper cable rates, but the departure of the Imperial journalists from London to the provinces has helped to stay the fall, although it did little to assist prices to recover their lost ground. Eastern Preference is ½ lower, otherwise the group to which this stock belongs has no quotable changes. West India and Panama shares dropped, and fresh flatness has befallen Anglo-American Telegraph Deferred, the price giving way to 15⅝. Mackay Companies' common shares rose substantially in response to New York advices, and Anglo-American Telephone and Telegraph stock has gained 2, the recently-issued report bringing in buyers on this side. Globe Telegraph Ordinary shares hardened a trifle.

National Telephone Deferred is a shade better after its drop, but the junior preferences tend to weaken. United River Plate Telephone are the turn lower. Marconi's have retained their rise.

Canadian-Mexican properties have been gyrating freely, and at one time it looked again as though the market were to experience a thorough slump. This, however, was fortunately avoided, and prices rallied, the net movements being comparatively small except in the case of Mexico Trams and Mexican Light and Power, the prices of both losing 2 points. Sao Paulo Trams at 155½ are 1½ down, and Rio shares at 99 show a point fall. The Kaministiqua Company announces a quarterly dividend of 1 per cent. upon its common shares.

Electricity supply descriptions exhibit their customary quietude. Westminster Preference are 2s. 6d. lower, Kensingtons fell 5s., Urban Preference 2s. 6d., and Smithfields 1s. 3d. One or two slight movements in the Debenture stocks reflect business of a purely retail nature. Victoria Falls Power Preference eased off when the Kaffir Market fell, and River Plate Preference lost part of their last week's advance.

Rubber shares developed fresh strength and activity upon the general attention drawn to the fact of Para rubber reaching a record price last Friday. The market in the shares is once more broad and active under the genial influence of fresh buying. Several new companies have been launched within the past few days, and several others are on the point of being pushed off for presentation to the public.

Miscellaneous shares are mostly firm, the feature being the advances in Electric Constructions. In the market the movement is declared to be due to recognition by the public of the cheapness of the shares. British Aluminiums are recovering from their recent depression. On the other hand, falls are marked against British Westinghouse Preference, Callender's, and Castner-Kellner shares.

Yorkshire (Woollen District) Tramways Co., Ltd.—The directors have declared a dividend of 2 per cent. (4¼d. per share) on the ordinary shares for the past year, placing £1,500 to renewals fund, £1,000 to capital redemption fund, £500 to depreciation and reserve fund, and carrying £608 forward.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Shares. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations June 8th.	Closing Quotations June 15th.	Business done week ended June 15th, 1909. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅜ — 3½	2⅜ — 3½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	100	5 %	5 %	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 0
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143¼—144½	145½—146½	145⅝	..	+2	5 9 3
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	98½—100½	98¾—100¼	..	..	..	3 19 7
598,180	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	57 — 59	57 — 59	57	..	..	5 6 5
8,300,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	99 —100	99½—100¼	100	99	+ ½	5 19 8
8,300,910	Do. do. do. Deferred	Stock	½%	1½%	1 %	8/-	16 — 16½	15½ — 15¾	16⅛	15½	— ⅜	3 4 6
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	+ ⅛	4 8 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	..	..	..	4 15 6
2,431,850	Commercial Cable, Sting. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	91 — 93	90½ — 92½	91½	90½	— ½	4 6 6
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8¼ — 8¾	8¼ — 8¾	8¼	..	..	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅜	2¾ — 3⅜	..	..	..	5 3 9
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¼ — 9	8¼ — 9	..	..	..	5 11 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	8 16 6
60,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	12⅜ — 13⅛	12⅜ — 13⅛	12⅞	12½	— ⅛	6 10 0
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	101 —103	100 —102	..	..	—1	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	132 —135	132 —135	133½	133	..	5 3 8
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	85½ — 87	85 — 86½	86½	85½	—1½	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 — 105	103 —105	104¾	..	..	3 16 2
800,000	Eastern Extension, Australasia, and China Tele Do. 4 % Deb. Stock	10	7 %	7 %	7 %	7 %	11⅞ — 12½	11⅞ — 12⅜	12	..	..	5 14 3
752,400		Stock	4 %	4 %	4 %	4 %	101½—103½	101¾—103¾	102¼	..	..	3 17 4
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10⅜ — 11⅛	10⅜ — 11⅛	11⅛	11	— ⅛	5 2 3
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	12⅜ — 13⅛	12⅜ — 13⅛	13⅛	12½	..	4 10 7
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	27 — 28	27 — 28	28	27⅝	..	6 8 7
10,000‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½ — 53½	51½ — 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	78 — 82	78 — 82	..	..	..	4 17 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	73 — 76	..	..	—2½	5 5 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜ — ⅞	⅜ — ⅞	17/3	16/9	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞ — 1	⅞ — 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 12 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108¾	108	107½	..	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120 —122	120½—122½	122⅜	121	+ ½	4 18 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11	10⅝ — 11	10¹³/₁₆	10½	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½ — 11	10 — 10⅜	..	..	— ⅛	5 11 7
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5 5/16	5⅛	—1/16	4 6 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	98½	..	..	3 10 0
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	102	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅝ — 1⅞	1⅝ — 1⅞	..	..	..	5 6 8
50,000	Do. do. 6 % Cum. Pref...	1	6 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	..	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 11 7
11,889‡	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8¼	7⅞ — 8¼	7⅞	..	..	4 18 9
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100—102	..	..	..	4 8 3
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	128 —131	128 —131	..	..	..	4 11 7
120,000	United River Plate Telephone	5	6 %	6 %	6 %	..	6⅞ — 7⅛	6⅞ — 7⅛	..	..	— ⅜	5 18 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	..	..	..	4 18 0
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 6
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13½ — 14	13¾ — 14	13⅞	13⅝	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102¼	101½	..	3 17 8
88,891	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅞	13/6	11/3	—1/16	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8⅛ — 8¼ xd	8⅛ — 8¾	8⅝	..	..	6 17 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	..
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	9 %	10 %	9½ — 9⅝	9½ — 9⅝	9⅝	9½	..	5 2 7
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5⅞%	6 %	6⅜ — 6⅝	6⅜ — 6⅝	6⅜	6⅛	..	4 14 1
978,280	Do. 4 % Deb. Stock	..	..	..	..	..	94 — 96	94 — 96	94½	92½	..	4 6 6
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	103½—104½	104	..	+ ½	4 15 8
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	4⅛ — 4⅛	4⅛ — 4⅛	88/6	..	..	4 7 4
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1 — 1⅛	1⅛ — 1⅜	..	..	+ ⅛	20 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2⅛ — 2⅜	2⅛ — 2⅜	50/-	..	+ ½	14 14 8
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3¾ — 4	3¾ — 4	70/-	..	..	7 10 0
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3½ — 4½	3½ — 4½	..	..	..	4 8 11
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 —100	95 —100	..	..	..	5 10 0
600,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	143 —147	143 —147	134	123	—2	5 8 10
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	126 —127	122 —125	..	..	..	4 16 0
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109 —112	..	..	..	4 9 2
323,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	100	..	..	4 5 9
133,301	British Electric Traction	10	3 %	Nil	Nil	..	⅞ — 1⅛	1⅛ — 1⅜	20/-	19/9	+1/16	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	2⅝ — 3⅛	2¾ — 3⅛	60/7½	..	..	8 17 9
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	89 — 93	92 — 95	94½	92½	+2½	5 5 3
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 72	68 — 72	71	69	..	6 5 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅞ — 7⅞	7⅞ — 7⅞	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6½ — 6⅞	6¼ — 6⅝	..	..	..	4 7 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	105 —108	105 —108	107	..	..	4 3 4
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	¼ — ⅜	3/16 — 7/16	6/6	5/3	—1/16	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	40 — 44	40 — 44	43	..	..	9 1 8
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731	3	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	3	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	29 — 33	29 — 33	..	..	..	15 12 8
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	..	4⅜ — 4⅝	4⅜ — 4⅝	87/6	..	..	6 6 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 20,880..	5	5 %	5 %	5 %	5 %	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	4 15 3
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100—103	100 —103	100	..	..	4 7 5
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9½ — 10½	9½ — 10½	..	..	— ½	7 6 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 8 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	106½	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	—1/16	6 4 8
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	102 —106	102 —106	..	..	..	4 4 11
1,893,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	66 — 68	65 — 67	65	64½	—1	4 17 0
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	50 — 52	50 — 52	49½	..	..	4 16 2
1,480,000	City and South London Railway	Stock	1½%	2½%	2½%	1½%	32½ — 33½	32 — 33	33	32	— ½	4 10 11
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	5 %	5 %	5 %	1 — 1⅛	1 — 1⅛	..	..	..	9 7 6
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	95 — 98	94 — 97	..	..	—1	5 3 1

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations June 8th.	Closing Quotations June 15th.	Business done week ended June 15th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 3/32 — 1 1/4	1 3/32 — 1 1/4	..	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 3/32 — 1 3/32	1 3/32 — 1 3/32	..	..	..	4 16 0
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13— 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	4½%	2½%	..	1/4 — 3/8	1/4 — 3/8	..	..	..	15 0 0
17,189	Do. "A" shares, 01—017,189 ..	5	4½%	4½%	2½%	..	1 — 2¼	1 — 2¼	..	..	..	5 0 0
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	70 — 75	70 — 75	71	70	..	5 6 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	10/-	..	+ 1/-	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890..	2	7 %	7 %	7 %	7 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	+ 1/4	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7 3/8 — 7 5/8	7 3/8 — 7 5/8	..	..	..	6 9 0
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	3/4 %	Nil	3/8 — 7/16	3/8 — 7/16	..	..	+ 1/8	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10 1/8 — 10 1/2	10 1/8 — 10 1/2	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11 3/8 — 12 3/8	11 3/8 — 12 3/8	..	..	..	6 1 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5 3/8	5 — 5 3/8	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 — 106	104 —106	..	..	..	4 5 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	..	14 1/2 — 15 1/2	14 1/2 — 15 1/2	15	14 1/16	..	6 11 2
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	1/16	Nil	1/16 — 1/8	1/16 — 1	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	3 %	Nil	1 3/4 — 2 1/4	2 — 3	..	..	..	4 8 11
399,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	3 — 4	3 1/4 — 4	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3 2/3%	2 — 3	2 1/4 — 3 1/4	43/9	40/7½	..	12 10 0
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	..	4 %	70 — 74	70 — 74	..	..	..	5 8 1
5,732,062	Metropolitan Consolidated	100	2½%	1 2/3%	1 2/3%	1 2/3%	38 — 39¾	38¾ — 39¼	39	38⅞	..	6 1 0
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	69 — 71	69 — 71	70½	69⅜	..	3 17 6
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	16 3/4 — 16 7/8	17 — 17 1/8	17 7/16	16⅝	+ 3/8	Nil
391,397	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	3/8 — 7/16	3/8 — 7/16	..	..	..	..
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	3/32 — 1/8	3/32 — 1/8	1/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	13/32 — 7/16	13/32 — 7/16	15/6	..	..	5 19 5
600,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	98 - 100	99 —101	99½	..	+1	4 9 1
£6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	..	146 —148	144 —146	146½	140½	—2	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	98 — 95	92 — 94	95⅞	92½	—1	5 6 5
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	3/16 — 7/32	3/16 — 7/32	..	..	..	8 13 0
245,500	Do. 6 % Cum. Pref.	1	5 %	6 %	6 %	5 %	1/4 — 5/16	1/4 — 5/16	11/6	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89 xd	86 — 89	..	..	..	5 1 2
87,250	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	32½ — 34	32½ — 34	33½	32½	..	6 0 0
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 — 103	..	..	..	3 17 6
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	..	101 — 102	101¾—102½	..	..	..	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	89 — 91	89 — 91	90½	..	..	4 18 11
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	37 — 39	38 — 40	..	..	+1	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	3/8 — 7/16	3/8 — 7/16	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 1/16 — 8 1/16	2 1/16 — 3 1/16	..	..	..	7 15 6
246,404	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 78	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5¾%	5¾%	5¾%	4½ — 4¾	4½ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8½ — 9	8¾ — 9	..	..	..	5 11 1
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	81/10½	..	..	4 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3¾ — 4⅜	3¾ — 4⅜	..	..	..	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4¾	4⅜ — 4¾	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4¼	3¾ — 4¼	78/9	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	96 — 99 xd	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3¾ — 4½	3¾ — 4½	80/-	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10¾ — 11	10¾ — 11	10⅜	10 1/16	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜ — 12½	11⅜ — 12½	..	..	..	4 16 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —123	121 —123	..	..	..	4 1 4
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	102	..	..	4 6 7
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	6 18 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98	96 — 98	..	..	..	5 2 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅝ — 8⅞	8⅝ — 8⅞	..	..	..	5 14 3
50,997	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅛	10⅜ — 11⅛	..	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	1/8 — 3/16	1/8 — 3/16	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	60 — 63	60 — 63	..	..	..	7 2 10
$8,150,000	Electrical Dev.Co.of Ontario, 6% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	88 — 90	88 — 90	88½	..	..	5 11 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4¾ — 5	4¾ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5¼	5 — 5¼	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	98 —101	..	..	+1	4 9 1
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅞ — 7⅞	7⅞ — 7⅞	7/6	..	— 1/-	5 11 6
$2,400,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	100—101	100½	100	+ 1/-	4 19 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7⅜ — 7⅝	6¾ — 7⅛	..	..	— 1/2	5 8 6
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	98 —101	..	..	+1	3 19 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	5 11 8
274,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 96	90 — 94 xd	92/6	88/9	..	4 3 4
300,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 5 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 5 9
220,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
348,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	85 — 88	85 — 88	..	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds		5 %	5 %	6 %	5 %	86 — 88	83 — 85	88	81½	—3	5 17 8
12,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	72 — 74	70 — 73	73	71½	—1½	4 14 7
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	108 —110	107 —109	109½	..	—1	6 7 3
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	87½ — 88½	87 — 89	88½	87	+ 1/-	5 13 0
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500..	5	8 %	8 %	8 %	2½%	4⅜ — 5	4⅜ — 5	..	..	..	2 10 0
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 15 8
196,500	{North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,365}	100	..	..	..	..	99 —101	99 — 101	99½	..	..	..
10,858	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11¼ — 12½	11¼ — 12½	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,510	5	7 %	7 %	7 %	..	6 — 6⅜	6 — 6⅜	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	2½%	2½%	1⅜ — 1½	1⅜ — 1½	28/6	..	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	5	6 %	6 %	6 %	6 %	1 3/16 — 1 1/8	1 3/16 — 1 1/8	..	..	— 3/32	5 4 4
194,584	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —107	103 —107	106½	..	..	4 18 6
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	9 — 9½	9 — 9½	..	..	..	6 13 4
40,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 13 4
150,000	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	— 1/8	Nil
85,000	South London Electric Supply, Ord.	4	4 %	5 %	4 %	5 %	2¼ — 3⅛	2¼ — 3⅛	..	..	..	6 9 0
20,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/16 — 1/8	1/16 — 1/8	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	21/4½	..	..	5 6 8
220,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100—103	100 —103	..	..	..	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	3/4 — 1	3/4 — 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	2 — 2½	1¾ — 2¼	..	..	— 1/8	10 10 6
75,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 84	80 — 84	83	..	..	5 7 2
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	3/4 — 29/32	27/32 — 29/32	18/-	..	+ 1/8	5 19 5
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	9 — 9½	8¾ — 9⅛	..	..	— 1/8	5 6 8
61,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5¼ — 5½	5¼ — 5½	5⅛	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent.. April 1st. 1909.

MERCURY MOTOR CONTINUOUS-CURRENT ELECTRICITY METERS.

By RANKIN KENNEDY.

The master patents for this class of instrument have all expired. From a technical point of view, their history has some aspects which are interesting to electricians, and the present time may be opportune for a brief *résumé* of their different stages of development.

No meter has been brought out for continuous-current supply to equal the mercury motor-meter in simplicity and accuracy. It, no doubt, has faults and failings which worry the supply engineers, but still it has held its own against all others; its manufacture is a large business, and must be carried on upon a factory system with perfect organisation and special plant to make it a paying business at current prices.

The makers may, therefore, be credited with having reduced its construction to the simplest and cheapest design.

Mr. George Hookham's name will always be associated with this class of meter, as will that of Ferranti. The original meters of these two inventors represent the two classes of mercury motor-meters, into which they may be divided.

The Hookham meter, broadly considered, is a motor-generator, a magneto-motor driving a generator with a short-circuited armature.

The disk in the mercury bath and in the permanent magnetic field is the motor armature; the disk in the brake magnetic field is a generator armature with a closed circuit or several closed circuits. If two magneto machines are coupled shaft to shaft, one having its armature short-circuited through a low resistance, and current is sent through the other armature, the revolutions per minute will be proportional to this current, very nearly. Friction will, of course, cause a departure from proportionality, but this can be compensated for by a few turns of wire carrying the current as a series winding to strengthen the motor field or weaken the brake field.

The original Ferranti meter belongs to another class, wherein there is no magnetic brake; it is not a motor-generator, but simply a series motor, working against the fluid friction of the mercury. The torque on the disk is proportional to the square of the current, and the fluid friction is as the square of the speed of the disk or vanes. Hence, within certain limits, Ferranti succeeded in obtaining a fairly straight characteristic curve in this type of meter. In its later form a permanent magnetic field was added, to enable the motor disk to start up at low loads. There is another meter of this class in the market, but it is not a type of meter likely to be a survivor in the coming competition.

In Hookham's first meter with a mercury bath and an immersed disk, the motor field was uniform, passing equally through the disk faces; under these conditions no induced currents could be generated in the disk while rotating in the field. In order to generate induced currents to act as a brake the field must be discontinuous, hence one or more small fields were applied to the brake disk, and induced currents then circulated in the disk around the small fields while the disk revolved. A disk revolving in one large uniform field has a potential difference generated between its centre and circumference, and a connection must be made between the centre and circumference by an external conductor in order to get a current, but a disk cutting through one or more fields which cover it partially allows current to flow between the parts outside the flux.

In Hookham's next improvements he made the permanent field cut through the motor disk twice, and the current to flow along its diameter from edge to edge. It is clear that in this case, as the two fields did not embrace the whole disk, there would be induced currents generated in the moving disk acting as magnetic brakes; and here we have the first example of a mercury motor-meter in which the one disk acts as a motor and generator.

The patent, however, does not claim this idea, and the separate brake was still retained. The separate brake offered facilities for regulating and adjusting the speed, advantages which may yet lead to a return to the use of separate brake disks and fields.

In Hookham's next meter the well-known bell-shaped motor was introduced without a separate brake. The magnetic field was made one-sided, so that currents were induced in the bell armature, acting as a brake to some extent; but, judging from the amount of series-winding required to compensate for friction, and the consequent great increase of the field strength as the load increased, it would appear to act in reality on the same principle as the Ferranti series motor, working chiefly against the friction of the fluid.

Finally, Hookham applied one small concentrated magnetic field upon the motor disk, and sent the current across this field from the edge to the centre. As the disk revolves under the influence of the current and field, induced currents are set up which brake the disk, and so he arrived at a very simple meter with one disk and one field.

It is difficult to see how such a meter can be compensated by any series winding, for such a winding would equally strengthen or weaken the motor and brake; yet it has a series winding on a magnetic shunt core, to give compensation for friction, so that it would seem that a strengthening of field increases the motor torque to a greater extent than the brake resistance, a remarkable fact which requires some explanation.

In the original Ferranti meter, paddles were used in the mercury, and these moved at some speed near the mean speed of the mercury, taken near the centre and edge.

In the new Ferranti Co.'s meter (Hamilton's patent) we have the idea of employing one disk to act as motor and brake between two or more separate poles.

As made, there is one pair of poles for driving and one pair for braking. As a matter of fact, both act as brakes, and so it is, in this case also, difficult to account for the compensating effect of the series coils.

To the writer it seems that a separate brake is desirable, as it gives the power of easy compensation and adjustment of speeds without electrical shunts. A portion of the current is sometimes shunted past the mercury bath in order to adjust the speed. This is not a safe practice, as any change in the mercury bath or the contacts immediately alters the rate of the meter.

The subject is one worth consideration, and these notes may bring forth some useful discussion.

THE SCIENTIFIC TRAINING OF AN ENGINEER.

By "NABLA."

In every town of importance nowadays, facilities are provided for gaining an insight into the theoretical side of the electrical industry. Classes of varying degrees of difficulty are provided to suit all requirements, and such classes are maintained by efficient lecturers and instructors. In spite of these advantages, however, the modern electrical engineer generally has but a poor knowledge of the principles of electrical science as a whole. His acquaintance with the subject of continuous currents is, from the simple nature of the subject, necessarily sound. With alternating-current theory he is less at home, and of the principles of electrostatics, electrolysis, electric discharges through gases, and electric waves, he has but a hazy notion. His knowledge of the theory of kindred sciences is meagre in the extreme, being confined to the most simple and commonly occurring applications of the most elementary principles. The reason for this state of affairs is easily discovered. The modern courses of classes for electrical students are, to a great extent, designed to teach the engineer what he would better learn by actual experience of a practical kind, rather than to instil into the mind of the young engineer the fundamental principles of the science upon which his profession is based. It may be urged that this should be the object of the technical

class, that scientific training is only of real use to the engineer, in the measure that it has a direct monetary value. In these days of the struggle for reduced works costs, the theory of the heat engine is little taught, a study of the details of water-tube boilers being accounted of greater importance. Plausible as the arguments may be, it must appear on consideration that the class training of an electrical engineer should be for a better purpose than merely to supplement his actual practical experience. An acquaintance with the details of a valve gear or of an oil-break switch is gained better in a central station than from a lantern-slide in a lecture-room. The function of a scientific training should be not only to assist the engineer to understand the various processes with which he deals, but also to teach him to see in them particular applications of comprehensive principles which he thoroughly knows, and with which he is quite familiar. It would seem, therefore, that the curriculum of the modern technical college is not moulded on the most beneficial lines. The great amount of time spent on Ohm's law, the laws of combined resistances, sizes of cables, and internal resistances of cells, important as these undoubtedly are, do not, in the way now taught, prepare the student for the fact, which he should soon learn, that the wire does not carry the current, but merely directs the flow of the electrical energy. The lack of inclination to teach the calculus early in the scientific career makes the treatment of alternating currents quite unsatisfactory. How many engineers understand why, if the two coils of an electric dynamometer be fed from two sources of supply, no deflection of the movable coil can take place unless the frequencies of these circuits bear a simple numerical relation? How many could give a simple investigation proving this?

By neglect of the study of electrostatics a student comes to think only of the magnetic field being produced by a current, and not as produced by the movement of electricity generally. More time is spent on the details of dynamo, alternator and transformer design than upon an intelligent understanding of the laws of motion and the mathematical definitions of force and work. Chemistry and physics are almost neglected, while in mathematics valuable time is often spent on simultaneous quadratics, solution of triangles, and the portions of geometrical conics of little use to the engineer.

The writer is well aware that generally the above-mentioned state of affairs is by no means reckoned as unsatisfactory, but, nevertheless, he is of the opinion that it leaves much to be desired. The study of electrostatics, despised as it seems to be by many teachers, is of immense importance in many branches of the science now coming into prominence, and some of the time spent on central station design (often a commentary by the lecturer on a celebrated paper read before the I.E.E. some years ago) might be spent in this way. The early study of the calculus would not only materially assist the student to understand alternating-current problems, but would also give him a clear notion of the principles of applied mechanics. The aim of this study should not be to give facility in differentiation and integration, but to give such an understanding of the three fundamental examples as will enable the student to apply them himself to the solution of problems with which he himself may be confronted in the intelligent study of the principles of his profession. The study of physics should be thorough in the parts relating to electricity, and in mechanics too much time cannot be spent on the notions of force, work and momentum. The study of elementary thermodynamics will not only be useful in view of the rapid development of the internal combustion engine, but will afford good mathematical training. The subject of chemistry in its relation to electrolysis, fuel and gas analysis is also of considerable importance.

The above ideas may be considered heterodox, antiquated, and ten years behind the times, but we should remember that the marvellous progress of the science of electricity has not only enabled us to light our streets and drive our factories, but also to understand a little about the nature of light, radiant heat and the constitution of matter. A course of study in accordance with the foregoing ideas may not produce an engineer able to design a dynamo of a size of which he will never have charge, or one who is acquainted with the details of an engine he will never see. It will turn out men who, with regard to electrical phenomena, understand what can be understood, and realise the magnitude of the problem still unsolved—who realise that a 100 per cent. efficiency of a complete generating unit is a scientific absurdity and not merely a reasonable abstraction impossible to attain, but who, perhaps, could not find the internal resistance of a Daniell cell in five different ways. Such men will be none the less efficient as engineers, but will be larger minded and will have a greater admiration for the wonderful science in the direction of which all physical knowledge seems to tend.

HYDRO-ELECTRIC INSTALLATIONS.

It is a sign of the times that two well-known firms, Messrs. Willans & Robinson, of Rugby, and W. H. Allen & Co., of Bedford, have taken up the manufacture of hydraulic turbines. Up to the early eighties British firms had a fair share of the hydraulic work in the Colonies and extra-European countries, but since the advent of the electrical transmission of power this branch of engineering has been greatly neglected at home. The recent installations at Foyers, Loch Leven and Snowdon were equipped with Continental turbines.

It is now possible to obtain complete hydro-electric transmission plants in Great Britain, including riveted or welded hydraulic piping, turbines, generators, transformers, high-tension insulators, steel poles, copper or aluminium overhead conductors, and sub-station plant at reasonable prices; and those consulting and other engineers who are ever on the look-out for opportunities for placing orders in the hands of their Continental or American friends have now been robbed of another excuse.

There are a number of water-power schemes projected in Japan, New Zealand, South America and Mexico, and provided that financiers at home give some support to the manufacturers, some share of this work ought to come to this country. There is also some opening in Canada, as there have been a number of Swiss turbines installed in the last few years—some of the largest size—owing largely to the superiority of the Continental turbines in the matter of workmanship, construction and design over the local machines or those of the States.

There are many openings for turbine electric plant in India, but it is to be feared that as long as the Indian electrical departments are in the hands of Royal Engineers and Americans, very little opportunity will be given to genuine British firms to compete. There are several promising water-power schemes in the Transvaal and Rhodesia, but thanks to the active co-operation of the British South Africa Co., practically all the turbine and electric work will be placed on the Continent. Some opportunities for water-power development are to be found in Spain, but owing to the neglect of this market in the past, and the activities of the German and Swiss Banking Institutions, there will be very few openings for British firms in that country.

It is to be hoped that home firms when taking up hydraulic work will not start American methods and attempt to standardise water turbines. Turbines, unlike steam engines, have to work under widely different conditions of head, volume of water, and speed of revolution, and in order to get machines to work with a good efficiency, at full and medium loads, practically each installation requires a special design and size of turbine. The absence of exaggerated standardisation by Continental turbine makers has made their machines in most cases superior to those of American construction.

One of the difficulties met with in hydro-electric installations is the turbine governing. A stream of water is not nearly so easy to regulate or control as a jet of compressible steam; owing to the momentum of a long column of water, the governor gear must in nearly all cases be heavy and has to be worked through some sort of relay or servo-motor. The governor-valves are either gear-driven, worked through clutches or friction disks, or worked by means of oil under high pressure, the valves being actuated by means of direct-acting rams. In many recent installations on the Continent where turbo-alternators have been used, two or more small

sets have been used to work the exciters and the oil pumps for the governors. In America the construction of turbine governors is quite a special business.

It has become quite a common practice in cases where the load is very variable, and the water supply is ample or no facilities are available, to use a water resistance as an artificial load and regulate by means of a motor-driven relay, thus keeping the load on the generators fairly constant and relieving the turbine-governors of much of their work.

Taking the subject generally, it must not be thought that power from a waterfall or rapid means a sort of gold mine for the undertakers, and that power can be obtained for nothing, as the capital charges in water-power plants are usually great, much greater than those of steam stations, and take up a large proportion of the selling price per unit, a fact that some Continental financiers have found to their cost. It is only when the load is fairly close to the power house, with cheap coal, or the load concentrated and fairly constant with long distances and dear coal, that water-power installations can become paying propositions.

It is frequently assumed by company promoters and theorists that manufacturers will flock to a district where cheap power is to be obtained, whether from steam or water, but it must be remembered that power costs in most industries are a very small proportion of the total costs of manufacture or production; even in cotton-mill work the power costs rarely exceed about 10 per cent. of the wages costs, and to the manufacturer inexpensive and efficient labour, cheap or competitive means of transport of the raw and finished materials, access to markets, freedom from high rates and taxes and the absence of socialistic regulations are of far greater importance than cheap power. It is rarely worth while for a manufacturer to change the position of his works for the sake of a fraction of a penny a horse-power-hour.

The most successful water-power plants are to be found in those countries where coal is dear, 25s. a ton and over, labour expensive, and the difficulties of transport great, conditions to be met with in many mountainous mining districts, and the relative cost of power a large proportion of the total production costs. It may seem a pity to see a waterfall running to waste, but it is by no means certain that the utilisation of a water power will be of profit to the undertakers, whatever the economic advantages may be to the country at large.

ELECTRICAL ACCIDENTS IN 1908.

(*Concluded from page* 961.)

The "miscellaneous" accidents include five fatalities. One of these occurred to a crane driver in the cab of a jib crane on a wharf. The system was 400 volts three-phase. The main switch, ammeter, &c., were fixed on a steel plate, which was in turn attached to woodwork. A leakage had occurred at the ammeter, causing this plate to become charged. The man was found lying on the floor of the cab, and his hand was burnt. It is supposed that he touched this plate or the case of the ammeter, whilst he also had his foot on the metal brake lever and so received the shock. The metal plate should, of course, have been connected to earth, but this had not been done. There is also an alternative explanation of the accident, as the switch, which was without a cover, was of a type which Mr Ram has often described and condemned, in which the hand is liable to touch live metal when grasping the handle. In either case the precautions were inadequate. The second fatality was on a three-phase system, 440 volts, at a travelling coal stamper at coke ovens. The attendant got up to oil a motor close to the trolley wires without first turning off the switch provided for cutting off the pressure, and came into contact with the live wires. The third fatality occurred at an electric welding plant. The man, who was a smith's striker, took hold of the end of a bar of metal which was being heated, and was killed by shock. Although the normal pressure in the welding circuit would be only a few volts, a leakage had occurred in the transformer from the primary winding where the pressure was 300 volts. In this case the welder was of a type having one insulated jaw, the other being in metallic connection with the frame. The accident could not have occurred if the frame had been properly earthed. An attempt had been made to earth it by connecting it by means of a single No. 18 wire to a small plate buried in the dry ground below the floor of the shop. A plate in such a position would be quite useless, even if the small connecting wire did not get broken.

The fourth fatality occurred to a man at work on a pole carrying live wires at 200 volts, and it is not clear whether he was killed by the shock or the fall. The fifth fatality was similar, death being due to a fall following shock from a 500-volt trolley wire. In both of these cases the pressure should have been cut off the wires before allowing the men to work.

One or two other accidents in this class, although not involving loss of life, are worth notice. One was due to an overhead travelling crane becoming charged up, a man on the ground at the sling getting a shock. Such cranes should be connected to earth through the running rails on the gantry. These rails should be electrically bonded together and earthed. A rubbing contact between the crane and the rails should be provided, as a connection through the bearings and the axles of the wheels cannot be relied upon, on account of the film of oil or grease used for lubricating.

Another accident from shock occurred to a man when taking hold of a leaky lamp fitting on a rising and falling pendant. The voltage was 200 alternating. He was in connection with earth through some metal that he was holding with the other hand. He could not leave go, but was forcibly pulled away by others. Another accident shows the necessity of using special flame-tight apparatus in places such as dry cleaning works or enamelling works where there is inflammable vapour about. In this case a fuse blowing set fire to a tank of benzene enamel 7 ft. away. Switches and fuses should not be in the same room with such substances, where it can be avoided. Another accident again emphasises the importance of properly earthing motor frames, &c. A man received a severe shock when using an emery wheel directly connected to a motor. Another accident shows the danger of leaky lampholders in places where the person handling them is in connection with earth. A man standing on earthed metal was about to change a lamp, and on taking hold of the holder received a severe shock, rendering him insensible.

Referring to examples of dangerous conditions of electrical plant which he has come across during the year, the Inspector says that it is instructive to note the carelessness and, in some cases, the indifference to the dangers which are in evidence even in recent work, and in quarters where one would expect to find the exercise of due care, quite irrespective of any regulations.

Thus he found in electrical stations of authorised electricity supply undertakings a number of dangerous switchboard passage-ways, some where there was no protection whatever at the high-pressure or extra-high-pressure conductors and apparatus, not even by cellular divisions between the different panels or conductors. In some the blades of isolating switches when in the "off" position—in which position, however, they were "live"—projected into the fairway of the passage, in two cases, just at the entrance, where a person would be most likely inadvertently to come into contact with them. The complete absence of any protection in the case of sub-stations of one local authority was admittedly due to the desire to keep down capital expenditure, yet in the generating station there were art tiles on the walls, oak panelling, and mosaic floor.

In a high-pressure generating station of a local authority, the switchboard, which, although not new, had been recently remodelled, had dangerous passage-ways—one having exposed live conductors at high pressure on each side, the width of the passage between the live conductors being only 2 ft. 6 in. In a generating station of an electric supply company, the main extra-high-pressure switchboard, not more than two years old, had a narrow passage-way at the back containing the switches and other apparatus along the side. There were bare connections from these to the bare bus-bars placed immediately above the passage and only 6 ft. 6 in. from the floor, no protection whatever being provided. The passage was, however, closed by a locked gate. There is, of course, no objection whatever to such an arrangement, provided that no one is allowed in the passageway while the conductors are live. In this case the whole would have to be shut down if cleaning or work of any kind should have to be done, there being no means of dividing the board into sections, and Mr. Ram was informed that this practice was adhered to. The arrangement nevertheless shows an extraordinary want of forethought in the case of a company giving a statutory supply, which in a very short time must necessarily be maintained continuously. When this time arrives, the switchboard will require entirely remodelling, otherwise at such times as work has to be done, some unfortunate attendant would, but for the regulations, have to risk his life. In a transforming sub-station belonging to the same undertaking, the medium-pressure distribution switchboard, consisting of switch fuses, was fixed on the wall behind the transformers. The extra-high-pressure leads to the transformers were brought up in front of the transformers, and for the top 12 in. or so the insulating material had been removed from the cables and a layer or two of ordinary wireman's tape had been substituted. These tail ends of the cables were therefore quite unsafe to touch, and yet anyone having to use the switch-fuses would perforce have to lean against them. The arrangement was just a trap. In the same sub-station the extra-high-pressure fuses were of an oil-immersion type; no oil was, however, in use or provided. Whether this was due to motives of economy or to ignorance did not appear.

Not only safety but ordinary convenience in working has often been sacrificed by unnecessarily cramping the arrangement of plant and apparatus. In the main sub-station of a public supply undertaking, having a bulk supply from a power company, cramping was totally unnecessary, as ample space existed within the building, but it was decided to try to augment the income by letting off a portion as a shop!

In some quite new underground transforming sub-stations already put to work, the floors were covered with water due to leakage through the structure. This fault, which is often a very difficult one to deal with when once the sub-station has been put to work, adds a considerable and sometimes permanent element of danger.

Mr. Ram found on factory premises and in public supply generating stations further examples of motor switches both for continuous and alternating current of a dangerous type, where the hand is liable to touch live metal when grasping the handle, fixed over iron floor plates where the user is in danger of getting a severe shock to earth, the precise conditions which have, in fact, led to fatal accidents. He also found a number of cases of series incandescent lighting on 550-volt alternating circuits, with the lamp-holders and metal shades not earthed, suspended out of doors or over iron floors where a leakage in the lamp-holder might readily, as it has done before, lead to fatal accidents.

The Inspector investigated, on behalf of the Mines Department, an electric shock fatality in a coal mine. This occurred on a concentric system with bare outer conductors earthed at the generating station. On the branch circuit where the accident occurred there were, however, fuses on both conductors. The outer conductors had become charged up owing to the connection with earth having been broken by reason of the fuse having blown while the fuse on the inner continued to hold. There should, of course, have been no fuses or break of continuity of any kind in the outer conductor. There was a local earth connection beyond the fuses, but it did not prevent the outer conductor from becoming charged so that the man who grasped it was killed, his hand being burnt to the bone. This local earth connection was made to a water pipe nearly 200 yards in length, partly lying in water. The connecting cable was, however, loose, both on the outer conductor and on the water pipe, and therefore did not make a good contact. It is, unfortunately, a very prevalent idea in regard to work above ground, as well as in mines, that any kind of connection is good enough for earthing purposes. Joints in earth connections require just as careful making as those in conductors.

In the case of the fatality at a welding machine, already referred to, and in other cases in previous reports, Mr. Ram has drawn attention to the futility of attempting to make serviceable earth connections by small isolated earth plates on different parts of a system, even if the ground be fairly moist. The object of earthing metal work, such as frames of motors, &c, is to prevent danger through its becoming charged by leakage from or actual contact with the electrical circuit. If the insulation of a system is practically perfect, it may be quite safe for a person to touch any part of the live conductors; the effect will merely be to bring the point touched to earth potential, and similarly, if there is a leakage say in a motor to its frame and the frame is "earthed," even by a small earth plate in nearly dry ground, it may nevertheless be sufficient to bring the motor frame to earth potential and prevent danger. In practice, however, no factory installation, however well carried out, can be relied upon to have an insulation anywhere approaching perfection; there is always the liability to a general leakage distributed throughout the system or definite leakages at one or more points. Consequently it is never safe when in contact with earth to touch any part of the conductors, as a current of dangerous proportions may pass through the body to earth and thence to points of leakage on the other pole. Similarly in the case of the failure of the insulation of a motor, a small earth plate in nearly dry ground will not be able to bring down the potential of the motor frame to that of the earth, but on the contrary, it may itself be raised to nearly the pressure in the conductors at the point of leakage, depending upon the relative values of the resultant leakage resistances on each pole. On the other hand, if the earth plate makes a good connection with earth, *i.e.*, of low resistance, the motor frame will be brought to practically earth potential if the leakages on the other pole are small. This condition may continue for a long time until, say, a fault develops on the other pole at some other motor. If the latter has also a good earth connection, a considerable current will flow between the two earth plates and the fuses protecting the circuits will blow, and the danger will thus be averted. Unless, therefore, some form of fault indicator is provided to show immediately when a leakage occurs on one pole, so that it can be remedied at once, it is necessary with isolated earth plates that they provide paths through the earth from plate to plate of such low resistance that in case of faults occurring on opposite poles sufficient current will flow to blow the fuses. It is seldom, however, that the conditions are favourable for this. It is a better plan to run a special earth cable or copper strip with the necessary branches throughout the installation, connecting to the various metal frames and covers, &c., which require earthing, this cable or strip being itself connected to earth. It need be so connected only at one point if a really good earth is provided. In this way, in a self-contained installation, *i.e.*, one having its own generating station, no large current has to flow through the earth, the earth cable providing a low-resistance path for the leakage current. If faults occur on opposite poles, the fuses protecting the branches on which they occur will blow. In the case of installations having the wires run in stout metallic tubing, properly jointed and electrically continuous, the tubing can be utilised in place of the earth cable. In the case of a system having one pole or the neutral point connected to earth, the earth cable or the metal tubing, as the case may be, should be connected to the same earth plate. If a fault occurs the fuse of the branch will at once be blown. In the case of a supply from public mains, especially by a system having one point connected to earth at the generating station or sub-station, special care should be taken to provide a good earth connection, as in this case it is impracticable to provide a metallic path for the leakage current to the earth plate at the generating station or sub-station, and one must therefore be provided for it through the earth.

In place of earth plates water mains are not unfrequently used, but sometimes objection is raised by the water supply authority. The size of the earth cables should in every part of an installation bear a definite relation to the size of the conductors in each part and should be large enough to carry, without overheating, current sufficient to blow the fuses protecting such part or branch.

In many factory installations where the wiring may be well carried out in good metal tubing, there is frequently a gap between the end of the tubing and the terminal box of the motor where 3 or 4 ft. of the cables is left entirely unprotected. These unprotected tail ends of the cables frequently get trodden on, or otherwise damaged, and become a source of trouble and sometimes of danger. The excuse for these loose wires is generally that the motor may require to be shifted on its bed, at any rate, where it drives machinery by a belt, and that it is therefore impracticable to take the rigid tubing up to the terminal box of the motor. One firm had an excellent exhibit of motors at the Manchester Electrical Exhibition showing how this difficulty can be readily overcome. The end of the rigid tubing and the terminal box are connected by flexible metallic tubing, properly secured at each end by a suitable metal union. The wires pass through this flexible tubing, and the position of the motor can be adjusted without difficulty. In another method for accomplishing the same object, used in several large factories, the metal tube containing the cables is rigid and is securely attached to the terminal box of the motor. This box is capable of adjustment in regard to the motor, allowing the latter to be moved sufficiently for belt-tightening purposes, the connections within the box being flexible.

TABLE III.—REPORTED ELECTRICAL FATALITIES, 1908.
SYSTEM AND VOLTAGE.

No.	Month.	Place.	Voltage of system.	System. A = Alternating, C = Continuous, 1 = Single-phase, 3 = Three-phase.
1	January ...	West Hartlepool	1,500	A.
2	February...	Manchester ...	20,000	A.
3	February...	Edinburgh ...	?	A.
4	February...	Eston Jetty ...	400	A 3.
5	May ...	Jarrow	275	A 3.
6	May ...	Middlesbrough	2,700	A 3.
7	May ...	Woolwich ...	6,000	A.
*8	July ...	West Ham ...	500	C.
9	August ...	Bolton	300	A 1.
10	August ...	Wigan	440	A 3.
*11	August ...	Winchburgh ...	200	C.
12	September	Preston	500	C.
13	October ...	Queenborough ...	6,500	A 3.
14	December	London	220	A 1.

* Fall following shock.

Although the exhibits generally indicated that much more attention is paid by manufacturers to questions of safety than was the case a few years ago, there were, nevertheless, examples showing that this point of view is still frequently overlooked by the designers of apparatus. There were, for instance, extra-high-pressure motors having insufficient protection of the high-pressure parts. There were numerous examples of switches constructed so that the user's hand is in danger of touching live metal. Grip fuses for heavy currents were shown, having the porcelain grip too small, in some cases scarcely 3 in. in length, so that the user could not grasp the handle with more than three fingers, and would probably in consequence touch the live metal with his other finger. In another case a distribution board of excellent workmanship and having good grip fuses, 4½ in. in the porcelain grip, was entirely spoiled by the arrangement being such that several of the grip fuses could not possibly be handled without the hand touching the live bus-bars or the main terminal lugs. Change-over switches were shown having the handle arranged in such a way that in switching on to one set of contacts the live blades coming from the other contacts would inevitably touch the user's hand or wrist.

The most important work accomplished during the year was undoubtedly that leading up to the establishment of the Regulations.

The Commissioner in his report, which was published in December, gave at length his carefully considered conclusions and recommendations. On the general questions, the most important were, first, that the Board of Trade should modify their Regulations, particularly in regard to the supply of electrical energy to factory premises by public supply undertakings, so as to avoid overlapping by the two departments—a recommendation which has been agreed to by the Board of Trade; and secondly, that the lower limits of pressure to which the Regulations should apply should be modified, in the case of most of the Regulations that it should be raised, and in a few others that it should be lowered. Subject to certain exceptions for special cases, the recommendation was that for the larger number of the Regulations the lower limit at which they should apply on factory premises should be for continuous current 250 volts and for alternating current 125 volts, whilst in public supply generating stations it should be 250 volts above earth, thus exempting from most of the Regulations all continuous-current generating stations working on the three-wire system and giving a supply up to 500 volts across the outer conductors. The Commissioner's draft was adopted by the Secretary of State practically as it stood, and Regulations were issued by him on December 23rd, the only alteration being in the wording of one or two Regulations in order to make the meaning clearer. The Regulations come into force on July 1st next, except as regards electrical stations, where they do not generally come into force until January 1st, 1910.

The Regulations, it is hoped, will have the effect, by improving the standard of work generally, of reducing the number of preventable accidents. It is evident, says the Inspector, that a large number of the accidents which have occurred in the past have been caused by neglect of such precautions as will now be required. Nearly all the cases of bad and dangerous work and conditions which he has described and commented upon in his annual reports for some years are now covered by the Regulations.

PROCEEDINGS OF INSTITUTIONS.

Interpole Designs.

By W. B. Hird, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Glasgow, May 11th*, 1909.)

In generators and motors running at abnormally high speeds, and motors in which a high range of speed variation by means of shunt regulation is required, the reactance voltage of the short-circuited coil becomes so high that commutation cannot be satisfactorily carried out without some special device. Broadly speaking, the reactance voltage of an armature is increased by increasing the length of the armature core relatively to its diameter, and also by decreasing the total magnetic flux of the machine.

It is possible by the use of interpoles to work with values of the reactance voltage five or six times as great as would be admissible in an ordinary machine, and with careful design the results are entirely satisfactory.

The discussions which have taken place on this subject have been full of warnings as to the danger of introducing interpoles into general design merely because they were useful in special cases, and very determined attempts have been made to restrict the use of interpoles to these special cases; but nevertheless the use of interpoles in machines running at moderate speeds and of ordinary output is becoming more and more frequent. It is also becoming more and more usual to find interpole machines specified by users, who have had experience of them and prefer them to ordinary machines.

The principle of all interpole designs is to provide a small auxiliary pole between two main poles, in such a position and so proportioned that it will provide just such a field as is suitable for counteracting the reactance voltage of the short-circuited coil under the brush. The interpole is always series wound, and its winding carries the whole or a fixed proportion of the armature current; thus, so long as the iron is not saturated, the field strength under the interpole is always proportional to the armature current, so that if the design has been correctly worked out to give good commutation, say at full load, the same relation will hold between field strength and the armature current to be reversed at any other load, and the machine will work sparklessly without any change of brush position at any load, the only limit being the saturation of the iron core of the interpole. That is, the machine will carry sparklessly and without change of brush position any overload up to the point where the increased ampere-turns on the interpole cause the iron to approach saturation.

One of the simplest formulæ for calculating the reactance voltage is that published by Mr. Mavor in a paper read at the International Engineering Congress in 1901. In a slightly modified form, this formula is: $P = e c f m \pi l/(p n)$, where P is the reactance voltage; e, the E.M.F. generated in the armature; c, the armature current; m, the number of turns in one section; l, the gross length of armature core; p, the number of poles; n, the number of magnetic lines per pole; f, the number of lines per unit length of core due to 1 ampere flowing in one turn of the short-circuited coil. The value of f varies to some extent, but, for ordinary machines, it does not materially differ from 20 lines per inch length of core.

The value of the reactance voltage given by the formula is the maximum value; on the assumption that the current in the short-circuited coil varies as a sine curve, to obtain good commutation, it is necessary that a field be provided under the interpole such as to generate a voltage in the short-circuited coil equal to 0·636 P.

The number of turns in the coil is m, and if B be the number of revolutions per minute of the armature, D the diameter of the armature, and λ the length of the interpole measured parallel to the shaft, the E.M.F. generated in a magnetic field of density B will be: $m \times \pi$ D $\frac{1}{6 0}$ B $\times \lambda \times$ B; by hypothesis, this must be equal to 0·636 P, whence B $\lambda/l = 0 636\, e c f/(p n \pi$ D $\frac{1}{6 0}$ B).

If the interpole shoe is made of the same length as the armature core $\lambda/l = 1$, and the formula gives directly the value of B required in the interpole gap. It is usual, however, to make λ less than l whenever possible, the advantages being to lessen the leakage between interpole and main pole, and also to minimise as much as possible the interference with the freedom of ventilation which an interpole extending over the whole length of core would produce. It should also be noticed that, by decreasing the ratio λ/l, the value of B in the interpole air-gap is increased. If a very low value of B is used, there is no doubt that the reactance voltage of the short-circuited coil is increased by the presence of the iron pole-shoe, which decreases the reluctance of the magnetic path for lines surrounding the short-circuited coil.

If, however, the value of B is fairly high, this effect is much reduced, and the reluctance of the path and consequently the value of the reactance voltage is not appreciably affected by the presence of the interpole.

The width of the interpole shoe has been made equal to one slot-pitch plus one tooth-width, calculated so that the coil shall be under the interpole during the whole time of commutation; but, in practice, considerable latitude is possible in the choice of a pole-width, and from the point of view of leakage, the narrower it is, the better.

Since the interpoles are placed immediately over the brush—*i.e.*, on the axis of commutation—the whole of the armature ampere-turns act immediately in opposition to the interpole winding, and thus sufficient ampere-turns must be provided to neutralise the armature ampere-turns in addition to those required to give the requisite value of B in the air-gap. From this it will be seen that the number of ampere-turns required on an interpole is considerable. As a matter of fact, they are frequently in excess of the number required on the main poles. The fact, however, that the interpole can usually be made of small section, so as to keep the mean turn of the winding short, enables this number of ampere-turns to be obtained with only a relatively small expenditure of copper.

The number of interpoles may be made less than the number of main poles, but although this arrangement gives good results on small machines—say, 20-H.P. motors, in which the reactance voltage is not excessive—it has not been found satisfactory in machines of any considerable size.

In order to justify the use of interpoles in small machines, it must be shown that such a machine can, by the use of interpoles, be made either better or cheaper than could be done on ordinary lines of design.

Since the material and labour expended on the interpoles make up, especially in a small machine, a not inconsiderable proportion of the total cost, a corresponding saving must be found in the other parts of the machine, due to the fact that the reactance voltage may be considerably increased without spoiling the commutation. The directions in which such a saving may be looked for are the use of a reduced depth of air-gap, allowing of smaller magnets carrying less copper; reduced number of commutator parts, saving both labour and material in the commutator; and lastly, the possibility of working with a greater length of armature core relatively to the diameter.

The possibility of saving a considerable amount on the cost of any given machine by the latter means does not appear, up to the present, to have been fully taken advantage of. It is well-known that in the present practice the length and diameter are not chosen so as to give the machine most economical in first cost, and that greater relative length would almost invariably conduce to a lower cost price.

The curves in fig. 1 show for three different diameters the way in which the costs may be expected to vary, with d^2l as base line, and if it be assumed for the moment that the output of the machine watts/revolutions per minute is proportional to d^2l, the points

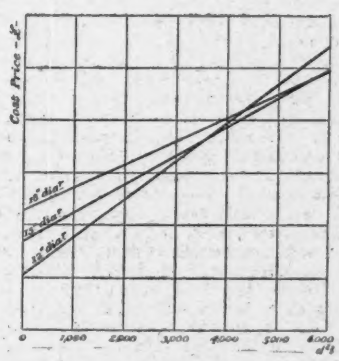

Fig. 1.

where these lines cross show the different lengths at which it is advantageous, from the point of view of economy in first cost, to pass from one diameter to the next larger diameter. The curves are fairly in accordance with ordinary present practice; they show only relative costs for the different diameters. The curves indicate that the economical lengths for the different diameters dealt with are considerably in excess of those usually met with. Thus the value of d^2l at which it becomes as cheap to make a 15 in. as a 12-in. machine is about 3,500, corresponding to a length for the 12-in. machine of 24 in., and the point where the 15-in. and 18-in. curves cross corresponds to $d^2l = 5{,}800$, or a length for a 15-in. machine of 26 in.

The question then arises whether the heating limit of output will not prevent the output of the machine being increased proportionately to its length. A long armature core dissipates the heat generated less readily than a shorter one, and when the length becomes so great as to require increased diameter of shaft, stronger spider, &c., the increased impediment to the circulation of air in the inside of the core makes the increased temperature rise more marked. When this limit to output is reached, it would appear that some method of forced ventilation, compelling the air to come in contact with the heated surfaces, might be devised to remove this limit to output also.

The use of forced ventilation of a simple form—*e.g.*, by fixing fan blades under the spider—and the use of forced commutation

by interpoles has in many cases been adopted as an after thought when a machine failed to come up to expectations on test, and perhaps from this fact has arisen a feeling that such devices are not legitimate and that their use in machines of normal output is a confession of failure to obtain a suitable design on ordinary lines. The contention here is that far from being a confession of weakness, such devices are an added strength in enabling a larger output to be obtained from a cheaper machine.

Present interpole designs rely mostly on the saving to be obtained by the use of reduced air-gaps and smaller commutators with fewer parts, and find an advantage in their use even without taking full advantage of the increased lengths made possible by the use of interpoles. The possible output of a machine as limited by sparking having been increased by forced commutation, it is to be expected that heating should now be found the limiting condition, and the logical conclusion appears to be that the next step is to devise improvements in the methods of getting rid of the heat, so that full advantage may be taken of the increased freedom which the interpoles give from sparking limit.

It should be noted that suggested lengths of air-gap for interpole machines are still made greater than the very small gaps to be found in induction motors, in which the mechanical difficulties have been successfully overcome, and also that the maximum lengths suggested still give a ratio of length to diameter much smaller than those commonly in use in the days of bipolar smooth-core machines. In view of these facts, it does not seem that mechanical difficulties need necessarily stand in the way of much longer armatures than we are at present used to, with smaller radial depths of air-gap.

On the score of efficiency it may be contended that increasing the losses to such an extent as to require forced ventilation will lower the efficiency of the machine; but the increased losses correspond to a more than proportionately increased output, and therefore to a better efficiency.

The losses will increase less rapidly than the length, and if an output proportional to the length can be obtained, the efficiency will be increased, and a margin left for the power required to circulate the air without lowering the efficiency from its former value.

Discussion.

The Chairman (Mr. W. W. Lackie) said that his first experience of interpole machines was not very happy. The characteristic of interpole machines was different from that of ordinary shunt-wound machines, and approached that of a compound machine; the result was that when they tried to run ordinary shunt-wound machines in parallel with a dynamo with interpoles, the interpole machine endeavoured to do all the work, set up a reverse current through the shunt-wound machines, and so operated the reverse-current cut-outs. Several methods of overcoming this difficulty had been suggested, one being to insert a resistance between the interpole and the switchboard so as to cause a drop in pressure when a heavy load was on. The method now usually adopted was to put one or two series windings on the field of the machine. The other trouble with interpole machines was that if the brushes were moved or required to be moved beyond the zone of the interpole, the difference of potential per segment of commutator was high and flashing-over took place. Fixing fan blades under the spider was not always as economical as installing a separate fan, but if the design was of a proper size to meet the output, simply fixing fan blades under the spider very frequently gave an efficient fan.

Mr. H. A. Mavor said he had received the suggestion of interpoles with suspicion, because he looked upon it from the point of view of the earlier days, when the design of machines was less understood. In applying interpoles to dynamos Mr. Lackie had pointed out certain difficulties, but these would not arise in a machine of large diameter.

Mr. M'Whirter said that if the cost could be kept down by the introduction of interpoles the other advantages were great.

Mr. Nicholson said that if the output of a machine was fixed by the heating limit, the best thing was to try to eliminate the cause of the heating instead of putting on a fan. The maker should see that he got the best iron for the armature.

Mr. M'Millan believed the most practical thing that had been done in the way of forced ventilation was an attempt to ventilate railway motors. He did not think that anything in the way of exact reliable data as to the cost of material in various sizes of machines could be taken from the curves shown.

Mr. Mavor explained that in trade factors fluctuated with prices, and in dealing with cost curves they must not expect to get within 10 per cent. of the real price. The only sound way to deal with costs was to take a curve and strike through a reasonable expectation, make a percentage allowance for contingencies, make a percentage allowance for cost, and then grab what profit was possible in open competition.

Mr. E. G. Tidd contended that if makers could cheapen their machines without depreciating them, and leaving out interpoles, they would do so.

Mr. J. R. Barr (Edinburgh) pointed out that Mr. Hird's position was that if they used interpoles they reduced the length of air-gap, and so reduced the amount of copper on the main poles. They could work with a lighter number of turns per commutator bar, which reduced the number of segments and therefore reduced the cost of the commutator. They had, however, also to look at the other side. In putting in interpoles they increased the amount of iron in the field-magnet system; they increased the amount of copper, because they required a certain number of turns to send the commutating flux into the armature. The increased copper required by interpoles would balance the diminution of copper in the main poles. The insertion of interpoles would also increase the magnetic leakage of the main poles. With reference to heating, in a motor fitted with commutating poles the thermal limit was reached before the limit set by commutation. The use of interpoles jammed up the space between the main poles, and so reduced the ventilating properties of the machine, and they would generally find that the temperature rise of both armature and field magnets in a machine with commutating poles was greater than in a machine without them. The extra output gained by interpoles was likely to be thrown away on the extra apparatus in the shape of fans, &c., to get rid of the heat thus induced.

Mr. T. E. Pearson asked if anyone had heard of water instead of air for cooling? And Mr. Scott said that Mr. Steinmetz, in America, had experimented with water-cooled dynamos.

In replying to the discussion, Mr. Hird said he did not intend that the curves should be taken as indicating exact costs, but only to show the region where it would be safe to pass from one diameter to another. Mr. Lackie, in his remarks about the disadvantages of interpoles, no doubt referred to machines of a larger size and a higher speed than those which the paper had specially dealt with. Perhaps Mr. Lackie referred to turbine-driven machines, and the whole subject of such machines was difficult. At the same time, the difficulty of running in parallel where only one machine had interpoles could be got over by making both machines with interpoles. They had got rid of the sparking limit by the use of interpoles, and now they were up against the problem of getting rid of the heating limit. Some kinds of iron were better than others, but the difference was really very small. They could reduce their copper losses by the use of aluminium, but that was also a very small percentage of difference. The only method of removing the heating limit was to find some means of getting rid of the heat more rapidly than they could do at present. Attempts had frequently been made to cool motors by means of water instead of air, but the great difficulty was that they got water inside the region of ventilation. If the water did not leak, they had condensation troubles. They had to turn their attention to devising the simplest means of getting a good circulation of air through the machine, and he believed that many efforts were at present being made in that direction.

Physical Society.

At the meeting held March 26th, 1909, a paper by Dr. J. A. Fleming and Mr. G. B. Dyke on the "Production of Steady Electrical Oscillations in Closed Circuits, and a Method of Testing Radio-telegraphic Receivers," was read by the authors. It was pointed out that at the present time a very large number of oscillation detectors have been invented for use as receivers in radio-telegraphy, but that there is great difficulty in obtaining quantitative and qualitative tests of those in actual radio-telegraphic stations. By the use of two nearly closed oscillatory circuits, one being employed as a transmitting station and the other as a receiving station, at a distance of a few hundred yards from each other, what is practically equivalent to radio-telegraphic stations with open oscillators at very large distances can be constructed. Methods were then described for producing in one of the closed circuits extremely constant damped oscillations by means of an induction coil or transformer, a spark-gap on which a steady jet of air is allowed to impinge, and a suitable mercury break. The receiving circuit consists of a square circuit of insulated wire which is pivoted in such a manner that it can be turned in any direction, the angular deviations being measurable on scales. This circuit is joined in series with a condenser of variable capacity and with the oscillator-detector to be tested. It is then possible to set this receiving circuit in such a position that it has no current induced in it by the oscillations in the transmitting circuit, but on turning it through a certain angle, sounds are heard in the telephone indicating the production of oscillations in the secondary circuit. The angle through which it has to be turned is a measure or indication of the sensibility of the detector. Instances were given of the ease with which detectors of various types could be compared for relative sensibility. The instrument has been found to be of great use in investigations on ionised gas detectors now being conducted at the Pender Electrical Laboratory. It was also pointed out that such an arrangement permits the effect of various types of oscillations to be investigated. This method of testing with closed circuits has the advantage that it can be conducted entirely within a large building and by one person. A self-acting apparatus was also exhibited for sending messages or signals by a punched tape.

A paper was also read by Dr. J. A. Fleming and Mr. H. W. Richardson on the "Effect of an Air Blast upon the Spark Discharge of a Condenser Charged by an Induction Coil or Transformer." When an oscillatory discharge of a condenser takes place across the spark-gap in the usual manner by charging the condenser with an induction coil or transformer, the intermittent spark which takes place is a complex effect. It consists partly of a true condenser discharge and partly of an alternating-current arc due to current coming directly out of the induction coil or transformer. This arc discharge is a source of difficulty in making accurate quantitative measurements with electrical oscillations, and to produce a uniform oscillatory discharge this true arc discharge must be prevented or arrested. It was shown in the paper that this can be done by a regulated air-blast produced in any convenient manner, and thrown upon the spark-gap, provided that the spark-gap is small. It was shown that the observations were more regular and the resonance more accurately delineated when the spark-gap was so treated with an air-blast.

In his reply to the discussion on both papers, Dr. Fleming said that in the interrupter coal-gas had proved itself to be incontestably superior to alcohol.

They had found it necessary to work at a certain distance from the transmitter, but when this was done the order of sensitiveness in which oscillation-detectors were arranged by the apparatus shown was also the order in which they were found to be sensitive when employed in actual radio-telegraphic work.

THE LATEST FORM OF QUARTZ MERCURY-VAPOUR LAMP.

The quartz lamp has been on the market for some time as an improvement on the ordinary glass tube mercury-vapour lamp. The use of quartz enables a much higher temperature to be employed, and this brings the consumption down

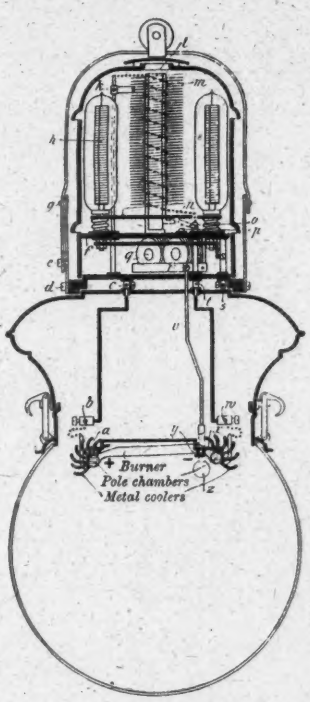

Fig. 1.

to about ½ watt per hemispherical candle-power, without reducing the life below 2,000-3,000 hours, and in some cases as much as 6,000 hours.

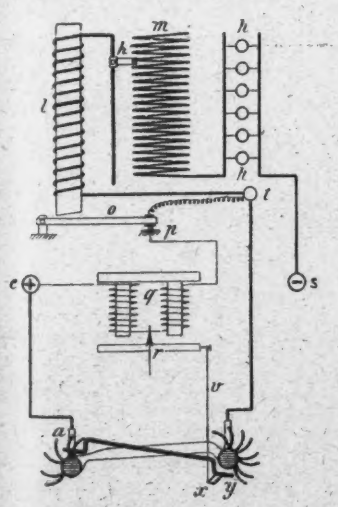

Fig. 2.

The mechanism of the lamp is extremely simple, as it has only to serve for starting the arc and not for regulating, as in the case of ordinary arc lamps.

The internal construction and the connections of a quartz lamp of the latest type for 220 volts, 3½ amperes, are shown in figs. 1 and 2. An enlarged view of the burner is shown in fig. 3. The burner consists of a short quartz tube with a cylindrical quartz electrode chamber at each end, into which the connections are led. The burner is carried on its axis $a\ x$, by two bearings, and is connected to the armature r of the shunt electromagnet q by the rod v. When the lamp is switched on, this magnet tips the tube up, so that the + pole rises, and the − pole falls, and a stream of mercury connects the two poles. The resulting current magnetises

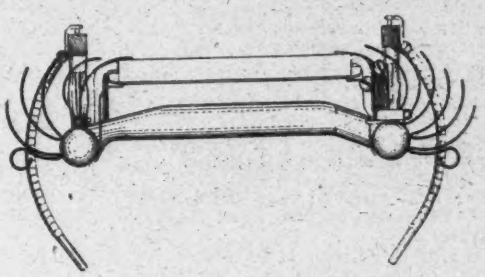

Fig. 3.

the choking coil l, which attracts its armature o and so breaks the circuit of the tipping magnet q at p. The burner then returns to its horizontal position, the thread of mercury is broken and the arc is struck.

The arc so formed can only be maintained if these tubes are free from air. If air is present the arc goes out, and the tipping process recommences. If only a little air is present, enough mercury will be vaporised after a few strikings of the arc to maintain the arc; but if too much air is present, the striking process goes on repeating itself indefinitely without resulting in a steady arc.

It is well known that the high efficiency of the mercury-vapour arc is chiefly due to the high temperature reached in it, this temperature being estimated at from 5,000° C. to 6,000° C. This high temperature can, however, only be reached by increasing the vapour pressure in the tube. Immediately after striking the arc the pressure in the tube is low; the temperature is, therefore, low and the voltage across the burner is also low and little light is given out. Gradually, however, the mercury in the electrode chambers becomes heated and the pressure rises, and with it the resistance and voltage across the burner rise.

The regulating or steadying resistance in front of the burner must, therefore, also vary. It should have a high value to begin with and then fall off. This change is effected automatically by using iron wire resistances. The increased current at starting is arranged to heat these iron wires to a dull red, which increases their resistance

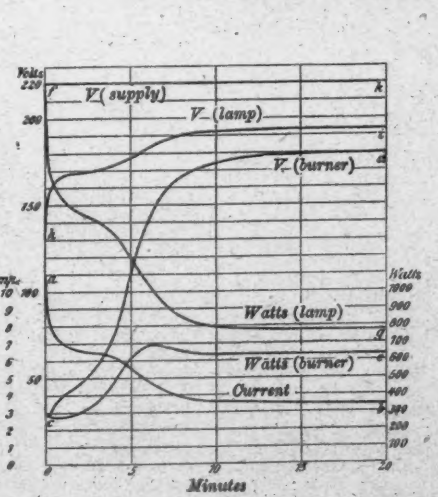

Fig. 4.

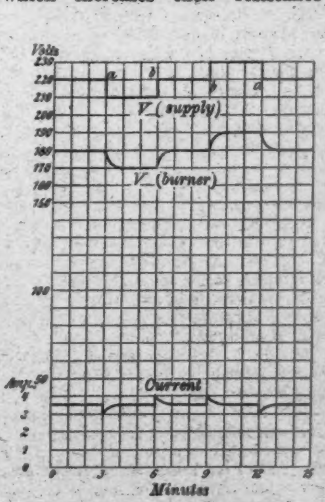

Fig. 5.

approximately four-fold. As the current falls off the iron resistance also falls, and so leaves more of the supply voltage available across the arc.

The variations which take place in the lamp during the first 10 minutes from starting are shown in fig. 4. It will be seen that the current starts at 10 amperes, and falls gradually to 3½. The ordinates between the curve *c d* and *h i* show the voltage across the iron-wire resistance, which varies from about 120 volts with the 10 amperes at starting, to only 13 volts with the normal 3½ amperes; the resistance, therefore, changes from 12 ohms to 4 ohms. As the voltage across the arc increases, the vapour pressure in the tube also increases, and at the normal voltage of about 180 across the arc, this pressure has risen to about 1 atmosphere, so that the walls of the tube are subjected to no appreciable pressure, either inwards or outwards, and this contributes largely to the long life of the tubes.

The choking coil mentioned above not only serves to cut out the tipping electromagnet after the arc is struck, but also prevents the extinction of the lamp under a momentary drop in supply voltage, such as is liable to occur in every circuit. Any sudden drop in current through the lamp immediately sets up a voltage of self-induction in the choking coil, tending to keep the current at its old value, and so tiding the lamp over the interval of low supply voltage. Beyond this risk of extinction, variations in the supply voltage do not affect the lamp because, as is shown in fig. 5, any variation in supply voltage (*e.g.*, a rise or a fall of 10 volts) produces a corresponding change in vapour pressure in the lamp, and after a momentary rise or fall of current the normal current is again reached within less than a minute.

The current of the lamp cannot, in fact, be permanently altered by variation of supply voltage or of regulating resistance, but depends almost entirely on the temperature of the mercury in the electrode chambers. If these are cooled by blowing upon them, then the current at once rises, and if they are artificially heated the current falls. In order to adjust the current to the desired value, these chambers are, therefore, fitted with special radiating arms, whose cooling effect can be readily reduced by bending two arms together to form a single arm.

Variations in the temperature of the surrounding atmosphere are found to be of little importance, but the presence of a draught has a marked effect, and consequently lamps intended to burn in the open have to have a reduced cooling surface.

A special point about these quartz lamps is the method of making the current connections into the tube. Since quartz glass does not expand with heat, the metallic connections must also be made of a material with no expansion coefficient, and the only known substance of this nature is the nickel steel discovered by Guilleaume, in Paris. Small cones of this steel are ground into conical seatings in the electrode chambers, and the joint is made air-tight by a little mercury kept in position by a cement.

At present only one type of burner is made for 100-130 volts, taking 4 amperes and 85 volts across the burner, and giving about 1,200 C.P. For 200-250 volts a burner for 2½ amperes, 160 burner volts, and 1,500 C.P., and another for 3½ amperes, 180 burner volts, and 3,000 C.P., are made.

Smaller types for indirect inside lighting are now being prepared for use on 110 volts with 2½ amperes and with 4 amperes, and on 220 volts with 1½ and 2½ amperes.—*E. T. Z.*

CATALOGUES AND CIRCULARS.

By "INTERESTED."

——— those circulars! Strong language, perhaps; but where can you find a business man who has not used such when catalogues, circulars and pamphlets innumerable are showered in upon him at every post?

The troublesome point is, how to deal with them. If dropped straight into the waste-paper basket, the chances are that a few days later one or more is wanted for reference, and, for the life of you, you cannot recall the name. In the event of them being all filed away in some form or other, they soon grow to unwieldly proportions and constitute a a nuisance, besides taking up a large amount of valuable space in the office. What is really the best method of dealing with them? Without a doubt some form of record should be kept, and it must be done, too, without accumulating vast quantities of literature. The writer has partially overcome the difficulty in the following manner:—

Every catalogue or pamphlet received is registered in a kind of cross-index book. First, the name and address of the maker or agent are entered, together with particulars of the goods described or illustrated, much in the same way as is usual with ordinary correspondence. Next, the goods themselves are registered under the proper headings to which the goods refer; for example, S. Shortcirc & Co.'s list of flame arc lamps would be entered at the opening devoted to those names commencing with the letter S, and again under A for arc lamps. The illustration below will fully explain my meaning.

Catalogue Index.

S	Name.	Address.	Particulars.
	S. Shortcirc and Co.	1, End Road, London, W.	Arc lamps, flame.

A	Arc Lamps. Particulars.	Name.	Address.
	Flame lamps, Eng. mfr. Pamphlet A.C, 1909.	S. Shortcirc and Co.	1, End Road, London, W.

Only a few of the price-lists and catalogues, referring to those goods mostly used, are retained. The others, after being indexed for future reference, are thrown away at once.

Now, in the event of particulars being required of any goods not included in the short list of the more important catalogues, as mentioned above, the index gives at once some information, whilst a postcard or telephone message will bring along full details of what is wanted by the next post. Surely it is worth this little trouble each time a special thing is wanted; and the delay caused is more than compensated for by the absence of the literary litter which would have been in the office somewhere if all the matter had been filed away.

Days will often pass without it being necessary to refer to any of the papers, or perhaps two or three may be required in a few days. Well, if the index book does not contain sufficient information, a polite request by post or wire secures full details by the next day. After all said and done, not one-twentieth part of the publicity matter received is ever of use to the recipient.

The system, which is not by any means new, is well worth a trial. I have found it work nicely in a small way, and can fully recommend it for trial on a large scale.

IS FOREIGN COMPETITION OVERRATED?

By A. G. M.

Much has been written on this subject, but in almost every case political arguments, Free Trade and tariff questions, &c., have been allowed to seriously interfere with the subject.

Comparing the number of foreign firms who had offices and did good business in this country, say, six or eight years ago, with the number left to-day, it will be found that a very large proportion have closed office and agency and now do no business worth mentioning over here.

Neglecting the smaller firms, the list is roughly as follows:—

	1900 to, say, 1904.	1909.
German firms	8	3
Belgian ,, ...	3	0
Austrian ,, ...	2	0
Swiss ,, ...	3	2
	16	5

Out of the 11 firms that have closed down, at least four did a very big business over here, but have evidently been unable to make it pay.

Again, on looking over the various firm's agencies, repre-

sentatives, &c., it will be found invariably that these are changed about every two years, or even less. Does not this point to the fact that the representatives are dissatisfied with the business they are able to do, or with the treatment they receive?

In some quarters it has been boldly stated that this constant changing is part of the foreign firm's business methods; the idea being to get rid of the agent or representative as soon as they have secured his connection and are in touch with his customers.

Applicants for berths with these firms frequently state that, at interviews, there is a deliberate attempt made to get as much information as possible from the candidate as to the quarters in which his present employers are getting orders. There is no doubt that the foreign firms have, in the past, often advertised for staff without accepting any of the applications.

The organisation of the Continental firms has been held up as ideal by some, and in theory it does, no doubt, look very well; in practice, however, it is so complicated that constantly some portion or other is breaking down.

Any inquiry for apparatus not strictly standard is "referred to works," and the time taken to get a quotation is simply out of all reason. One leading firm recently took eight weeks to quote for quite an ordinary type of inter-pole motor, the order being placed in England long before the Continental quotation was to hand. This is not by any means an isolated case, whilst, as regards deliveries, the dates put forward are very seldom even approached. As regards drawings, the state of affairs is even worse; it is quite impossible to get them until the machinery is almost due for delivery, and the first and even the second drawings sent are generally cancelled. The writer has repeatedly seen diagrams of connections that have had most glaring errors left unchecked, while in many cases the drawings were blue and red pencil marked, or rather scribbled on in a most untidy fashion. If the number of staff initials on such drawings were halved, and the reliable amount of checking done by each man were doubled, the improvement effected would be considerable.

In some of these firms the office staff and engineers actually fill up each day a species of workman's time-sheet showing what work they have done during the day; this is no fairy fabrication, as the writer has actually seen such a printed form. The next step in this direction would be the introduction of some form of time-recording machine, and then the office staff would be level with the workman. Happily, the average English employé is above such treatment, and can usually find more profitable means of employing his time than filling up such useless schedules.

In one direction these Continental people are certainly ahead, and that is, that they usually send out a first-class well-trained engineer who is able to give sound advice as regards the arrangements and type of plant to be installed. It is noteworthy, however, that these engineers are invariably Englishmen. In the early days when South Wales was the happy hunting ground, German engineers poured in. However, the fact that "All ze world has paid our price," does not seem to have been effective, and most, if not all, of these gentlemen have returned to their native land.

Certainly German mining machinery is still being sold in South Wales, but not by any means to such an extent as formerly. It is, however, only fair to say that as a rule this machinery is of high grade, while unfortunately some English firms have lately distinguished themselves by supplying mining machinery where quality has been sacrificed to cheapness. This is very deplorable, as it strengthens the position of one or two consulting engineers who are more or less associated with Continental machinery. In several instances orders for very large plant have undoubtedly been given to foreign firms by these consultants without even inviting English firms to tender; this can hardly be to the best interests of the purchasers.

In the steam-engine line the foreign makers have never had any hold in this country—excepting a well-known Swiss firm—and practically the only large German engines put down in connection with an English tramway scheme have not been a success by any means. Again, the turbine trade in this country is almost free from outside competition, very few Continental turbines having been installed. With large gas engines, on the other hand, the German firms have undoubtedly done a good business over here, principally due to the protection they had under the old patent law.

Taken on the whole, the foreign element over here have not by any means done the prosperous business some people have made out, as is clearly proved by the foregoing statements, and the cry of foreign competition in the electrical trade has been much overdone.

It is noteworthy that whereas the number of American firms that have protected themselves by complying with the new Patents and Designs Act is considerable, comparatively few of the German and Austrian firms have done so, and they are thus risking the forfeiture of their patents. This particularly applies to the various types of single-phase repulsion motor, for which the demand in England should be considerable, while abroad single-phase supply circuits are not very numerous.

These firms must know that British manufacturers are keenly watching for opportunities to take advantage of such forfeited patents, and one can, therefore, only conclude that our Continental friends do not see very rosy prospects as regards future trade in this country. Trade is undoubtedly bad, but foreign competition has little to do with it; the cause is more likely to be found in the free and easy way in which we allow the company promoter to float ventures that are rotten to the core, and in the heavy law costs that are involved in any legal matters—especially the winding up of a firm or concern where, by the time the legal gentleman have finished, 18s. in the £ has dwindled down to a mere trifle. Capitalists must cover these risks, hence while abroad there is no difficulty in getting financial help at 4 to 5 per cent., in this country a much higher rate of interest is demanded.

Again, when the German sees that there is no reasonable profit left, he withdraws from the competition; our home firms, on the other hand, go on paring down prices until they cannot even get enough out of a contract to meet office, &c., expenses.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

DOMINICA.—The following are free of duty:—Belting for machinery, of leather, canvas or india-rubber; bridges of iron or wood, or both combined; locomotives, rolling stock, rails, ties, and all materials and appliances for railway and tramways; steam boilers and steam pipes; telegraphic, telephonic and electrical apparatus and appliances of all kinds for communication or illumination; instruments and appliances of all kinds (and parts thereof) for the equipment and maintenance of any observatory or laboratory established in Dominica for scientific purposes by or with the approval of the Government; machinery and apparatus (and parts and fittings thereof), tools, materials and stores, imported by any contractor to the Government for use in the prosecution of any public work or undertaking contracted for by him, but only in cases where he has, by the conditions of his contract, been specially exempted from import duty, and the colonial engineer has certified in writing that such articles are necessary and proper for the work; machinery fuel and such stores as the treasurer may allow to be imported for the equipment and maintenance of any vessel propelled by any mechanical power and engaged in the coasting trade of the island.

Bricks and tiles	6s. 3d. per 1,000
Cement	2s. per barrel
Coal, coke and patent fuel	1s. per ton
Lime for building	6d. per barrel
Kerosene and rock oil, per case of 8 Imp. gals.	2s. 6d.
Kerosene and rock oil not in cases	4d. per gal.
Olive oil and cotton seed oil	1s. „
Other oils (except castor, cod-liver, and essential oils)	8d. „
Turpentine	6d. „
Electrical and other goods not specially mentioned in the Tariff	12½% ad. val.

N.B.—No person may import or establish any apparatus or installation within the Island for the purpose of, or in connection with, wireless telegraphy, without a licence from the Governor.

The value on which ad valorem duties are assessed is the invoice value of the goods at the place whence they were imported.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,790. "Improvements in the production of harmonic variations in the amplitude of high frequency alternating currents applicable to musical signalling by radio-telegraphy." A. W. Sharman. June 1st.

12,806. "Improvements in lanterns for electric lamps." H. Wardle. June 1st.

12,824. "Improvements in and relating to exhaustion of incandescent electric lamps." F. Harrison. June 1st.

12,825. "Improvements in and relating to exhausting incandescent electric lamps." F. Harrison. June 1st.

12,826. "Improvements in and relating to joining filaments to wires of incandescent electric lamps." F. Harrison. June 1st.

12,827. "Improvements in and relating to the manufacture of metal filaments of incandescent electric lamps." F. Harrison. June 1st.

12,828. "Improvements in and relating to the manufacture of metal filaments of incandescent electric lamps." F. Harrison. June 1st.

12,829. "Improvements in and relating to the manufacture of metal filaments of incandescent electric lamps." F. Harrison. June 1st.

12,830. "Improvements in and relating to the manufacture of filaments for incandescent electric lamps." F. Harrison. June 1st.

12,831. "Improvements in and relating to joining wires of filaments of incandescent electric lamps." F. Harrison. June 1st.

12,844. "Magneto-electric massaging machines." B. Seacombe. June 1st.

12,857. "Improvements in telephonic receiving and transmitting apparatus." P. M. Oliver. June 1st.

12,869. "Safety appliances for telephone, telegraph or other electric conducting wires." E. Hall. (Date applied for under Sec. 91 of the Act, May 29th, 1908, being date application in United States.) June 1st. (Complete.)

12,878. "Improvements in and relating to electric motor meters." Aktl.-Ges. Kortings Elektricitats-Werke. (Date applied for under Sec. 91 of the Act, November 9th, 1908, being date of application in Germany.) June 1st. (Complete.)

12,890. "Improvement in apparatus for illuminating medical lamps and applying electric currents for medical purposes." E. E. Greville. June 1st.

12,917. "Improvements relating to means employed for controlling the speed of bodies driven by alternating current electric motors." H. A. Mavor and Mavor & Coulson, Ltd. June 1st.

12,918. "Improvements in or relating to telephone-transmitters." C. E. Egner and J. G. Holmstrom. June 1st. (Complete.)

12,931. "Improvements in magnetic compasses." Kelvin & J. White, Ltd., and R. K. Mills. June 2nd.

12,937. "Improvements in and relating to electric power traction systems." R. J. Houghton, P. Allman and W. T. Gray. June 2nd.

12,970. "Improvements in and relating to systems for electrically controlling searchlights and like objects from a remote point." A. Le Blanc. June 2nd. (Complete.)

12,985. "Improvements in or connected with electrically-heated cooking apparatus." W. A. Lowden. (Date applied for under Rule 13, June 12th, 1908. An invention comprised in application No. 12,669, 1908, dated June 12th, 1908.) June 2nd. (Complete.)

13,008. "Improved form of box for preventing escape of electrolyte from electric storage batteries." R. Pape. June 3rd.

13,010. "Electrical torsiometer." C. H. Johnson. June 3rd.

13,014. "Improved form of sparking-plug." R. Pape. June 3rd.

13,036. "Improvements in the electro-deposition of metals." S. O. Cowper-Coles. June 3rd.

13,037. "Improvements in the electro-deposition of iron." S. O. Cowper-Coles. June 3rd.

13,040. "Improvements in and relating to electric frequency transformers." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) June 3rd. (Complete.)

13,041. "Improved arrangements for suppressing electric currents due to harmonics in the wave forms of alternating current dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., and M. Kloss. June 3rd.

13,059. "Improvements in alternating-current generators." W. F. Grafton and Johnson & Phillips, Ltd. June 3rd.

13,080. "Improvements in or relating to electric energy meters." Evershed and Vignoles, Ltd., and S. Evershed. June 3rd.

13,117. "Improved methods of casting circular lead grids for electric storage batteries." A. Hunter and R. Pape. June 4th.

13,119. "Method of transmission for ignition gear and other devices requiring a variable phase difference between the driving and driven member." A. S. Bright. June 4th.

13,129. "Distributing box for cables with multiple electrical conductors." R. Monnier. (Date applied for under Sec. 91 of the Act, June 6th, 1908, being date of application in France.) June 4th. (Complete.)

13,135. "Improvements in the manufacture of electrical condensers." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) June 4th. (Complete.)

13,142. "Improvements relating to electric rheostats, motor-starters and the like." A. H. Curtis, J. T. Mould and Adams Manufacturing Co., Ltd. June 4th.

13,177. "Improvements in sparking plugs." F. Pape. June 5th.

13,220. "Improvements in or relating to the sheathing of insulated electrical conductors." Siemens Bros. & Co., Ltd., H. W. Handcock, A. H. Dykes and J. J. Rawlings. June 5th.

13,228. "Improvements in or relating to incandescent electric lamps." C. O. Bastian. June 5th.

13,231. "Improvements in and relating to brush-holders for dynamo-electric machines." Allgemeine Elektricitats-Ges. (Date applied for under Sec. 91 of the Act, June 6th, 1908, being date of application in Germany.) June 5th. (Complete.)

13,234. "Improvements relating to clutches for electric automobiles or automobiles controlled electrically." C. M. de Sainte Claire. (Date applied for under Sec. 91 of the Act, June 27th, 1908, being date of application in France.) June 5th. (Complete.)

13,238. "Improvements in and relating to ploughs for electric tramcars." G. Laurie-Walker and J. T. Niblett. June 5th.

Tramway Horticulturalists.—The tramways employés on the Stockport Road and Hyde Road routes of the Manchester Corporation have decided to form a tramways employés' horticultural society, and the first annual show, extending over two days, will shortly be held at Levenshulme.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Means for Mounting and Feeding Carbons in Electric Arc Lamps. S. C. Mount and Beck Flame Lamp, Ltd. 15,846. July 20th.

Solid Electric Insulating Compounds. W. E. Lake. (Standard Varnish Works.) 16,885. August 11th.

Electric Switches. A. Snowdon. 17,142. August 14th.

Electrical Apparatus for Exhibiting Illuminated Letters and the like. C. Vaccaneo. 18,497. September 3rd.

Insulation of Switches, Current Breakers, Automatic Switches and the like. A. E. Peyrusson. 22,426. October 22nd. (Date applied for under International Convention, October 23rd, 1907.)

Electric Distributing Stations. Voigt & Haeffner Akt.-Ges. 22,562. November 1st. (Date applied for under International Convention, November 1st, 1907.)

Supports for Filaments of Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co., United States.) 23,069. October 29th. (Application for Patent of Addition to No. 16,531 of 1907.)

For Secondary Batteries an Improved Process of Manufacture of Plates and the Product Thereof. L. Fieldler. 24,224. November 11th.

Manufacture of Electric Incandescence Filaments from Tungsten or other Difficultly Fusible Metal. Siemens & Halske Akt.-Ges. 25,854. November 30th. (Date applied for under International Convention, December 11th, 1907.)

Arc Lamp with Pairs of Carbon Arranged Tangentially to the Axis of the Lamp. D. Timar and K. von Dreger. 27,143. December 14th.

Electric Furnaces. A. Voelker. 28,276. December 28th.

Appliances for Determining the Bearings or Positions of Ships and the like by means of Electromagnetic Radiations. R. A. Fessenden. 2,955. February 10th. (Date applied for under International Convention, February 11th, 1907.)

Electrically-Heated Tools. A. J. Boult. (O. A. Miller Treating Machine Co.) 10,521. May 14th.

Electrical Switchgear. H. W. Clothier and A. Reyrolle & Co. 10,536. May 14th.

Luminous Electric Radiators. British Prometheus Co., G. Copper and F. C. Sharp. 10,760. May 18th.

Portable Electric Lamps. H. F. Joel. 11,106. May 22nd.

Trolley Wheels for Electric Tramways, Railways and the like. V. G. Lironi. 11,606. May 28th.

Electrical Distributing Systems. British Thomson-Houston Co. and E. B. Wedmore. 11,979. June 2nd.

Automatic Apparatus for Controlling the Speed of Trains and like Vehicles. A. J. Boult. (Union Switch & Signal Co.) 12,178. June 4th.

Electric Cooking and Heating Apparatus. J. A. Abbott. 12,191. June 5th.

Electric Motors for Vehicles. C. R. Massone. 12,447. June 9th.

Electrical Contacts. G. Hookham. 13,215. June 22nd. (Cognate Application 26,978/08.)

Casings for Electric Interrupters. E. B. Hazleton. 14,646. July 10th.

Arc Lamps. L. Shaw. 15,116. July 16th.

Electrical Welding Especially Applicable to Teeth, Tines and the like. S. E. Page. (Universal Electric Welding Co.) 15,424. July 21st.

Electromagnetic Relay Apparatus for Polyphase Circuits. Allgemeine Elektricitäts Ges. 15,664. July 23rd. (Date applied for under International Convention, July 24th, 1907.)

Motor-Controlling Switches and the like. British Thomson-Houston Co., H. Bacon and E. B. Tuppen. 15,791. July 24th.

Utilisation of the High-Tension Electric Spark for Permanent and Indelible Writing without Ink. D. P. F. Ghadiali. 16,493. August 5th.

Insulating the Live Parts of Electric Switches and the like. Siemens Bros. Dynamo Works, Ltd., and E. G. Nicholls. 17,412. August 19th.

Disinfecting Means for the Mouthpieces of Telephones. A. Lewis, I. Lewis and R. Farkasch. 18,204. August 31st.

Construction of Field Magnets for Electric Generators or Motors. A. Schanschieff. 22,450. October 22nd. (Post-dated December 24th, 1908.)

Curing Process. A. J. Boult. (Electric Meat Curing Co.) 23,183. October 30th.

Electrical Condensers. M. Meirowsky. 26,808. December 10th. (Date applied for under International Convention, May 18th, 1908.)

26,973. See 13,215 of 1908.

Securing Thin Electric Insulating Covering to Fine Single Wires. Siemens Schuckertwerke Ges. 27,097. December 14th. (Date applied for under International Convention, December 14th, 1907.)

1909

Telegraphic Repeaters. G. L. Rawdon. 355. January 6th.

Process for Producing Long Voltaic Arcs. Centralstelle fur Wissenschaftlich-Technische Untersuchungen Ges. 2,216. January 29th. (Date applied for under International Convention, February 1st, 1908.)

Manufacture of Electric Incandescence Filaments from Tungsten or other Difficultly Ductile Metals. Siemens & Halske Akt.-Ges. 2,853. February 11th. (Date applied for under International Convention, February 11th, 1908.) (Application for Patent of Addition to No. 4,514 of 1907.)

Manufacture of Incandescent Electric Lamp Filaments and Apparatus therefor. British Thomson-Houston Co. (General Electric Co., United States.) 3,951. February 17th.

Wind Power.—Messrs. J. G. Childs & Co., Ltd., of Willesden Green, are exhibiting at the Royal Agricultural Society's Show at Gloucester next week one of their 24-ft. wind turbines, and this plant will, in addition to lighting their stand and that of the Country Gentlemen's Association, provide the energy for operating electric cooking apparatus, comprising a specially designed oven, which is more like a piece of dining room furniture than an adjunct of the kitchen, saucepans, steamer, grill, kettles, fans, radiators, flat-irons, an electric lift, butter churn, cream separator, deep well pump, circular saw, incubator, &c. All of these will be shown in operation, and the whole of the energy will be produced from the wind free of cost by the wind-power plant. It is to be hoped that Messrs. Childs will be favoured with an adequate supply of breeze.